



JOHN F. KENNEDY
SPACE CENTER

KSC TR-942

1970 February 18
(Supersedes TR-942
March 14, 1969)

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KSC LIGHTNING SUMMARY REPORT

THROUGH 1969



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JOHN F. KENNEDY SPACE CENTER, NASA

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KSC LIGHTNING SUMMARY REPORT

THROUGH 1969

ABSTRACT

This report presents an updated summary of the lightning activities recorded at the John F. Kennedy Space Center and the Cape Kennedy Air Force Station. Data was compiled during the periods 1903 through 1924, 1957 through 1962, and 1964 through 1969.

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SECTION I
INTRODUCTION

A. PURPOSE

This report presents an updated summary of lightning data recorded at various NASA facilities located at the John F. Kennedy Space Center (KSC) and the Cape Kennedy Air Force Station (CKAFS) through the year 1969.

B. SCOPE

Potential gradient and lightning stroke data are presented in tables and associated bar charts. The charts show the number of potential gradient activity days per month and the distribution of the average number of AM and PM hours per activity day for the months recorded.

C. GENERAL

Starting in 1964, potential gradient and lightning activity data in the KSC and CKAFS areas have been sampled and recorded by the Measurement Systems Division (IN-MSD) of the Information Systems (IN) directorate. Generally, data has not been acquired continually during the specified time period because of construction work, closing of facilities, or measurement station installation changes.

SECTION II

LIGHTNING DATA 1969

A. GENERAL

Lightning activity days that occurred in 1969 at KSC and CKAFS are presented in this section as charts and tabular listings. Potential gradient and stroke activity days are listed for each month.

Boundaries for launch area LC-39, the KSC industrial area, and CKAFS as well as the location of the measurement stations are shown in figure 2-1. Area boundaries are the equipotential lines between the nearest stations of two adjacent areas. Measurement station instruments are usually installed 3 feet above ground or on top of a building or other structure. During lightning activity, it is possible for a station close to the activity to make a recording while stations at a greater distance do not record.

Potential gradient is a condition that occurs when clouds contain an electron charge. The potential gradient in a cloud becomes a greater discharge possibility as the potential difference increases. In this report, an arbitrarily selected potential gradient of 2.4 kilovolts of potential per meter (2.4 kv/m) is used as an indication of activity. A discharge at other potentials is possible, however, potential gradient activity is indicated only when a level of 2.4 kv/m was reached or exceeded.

For the purpose of this report, stroke activity is defined as a lightning discharge between clouds, or between clouds and earth ground, without regard to direction of current or electron flow or direction of luminous travel.

B. DATA CHARTS

Table 2-1 lists the measurement stations and the page numbers of the data charts associated with the station. Preceding each set of data charts is a table that lists the monthly activity days for the pertinent measurement station.

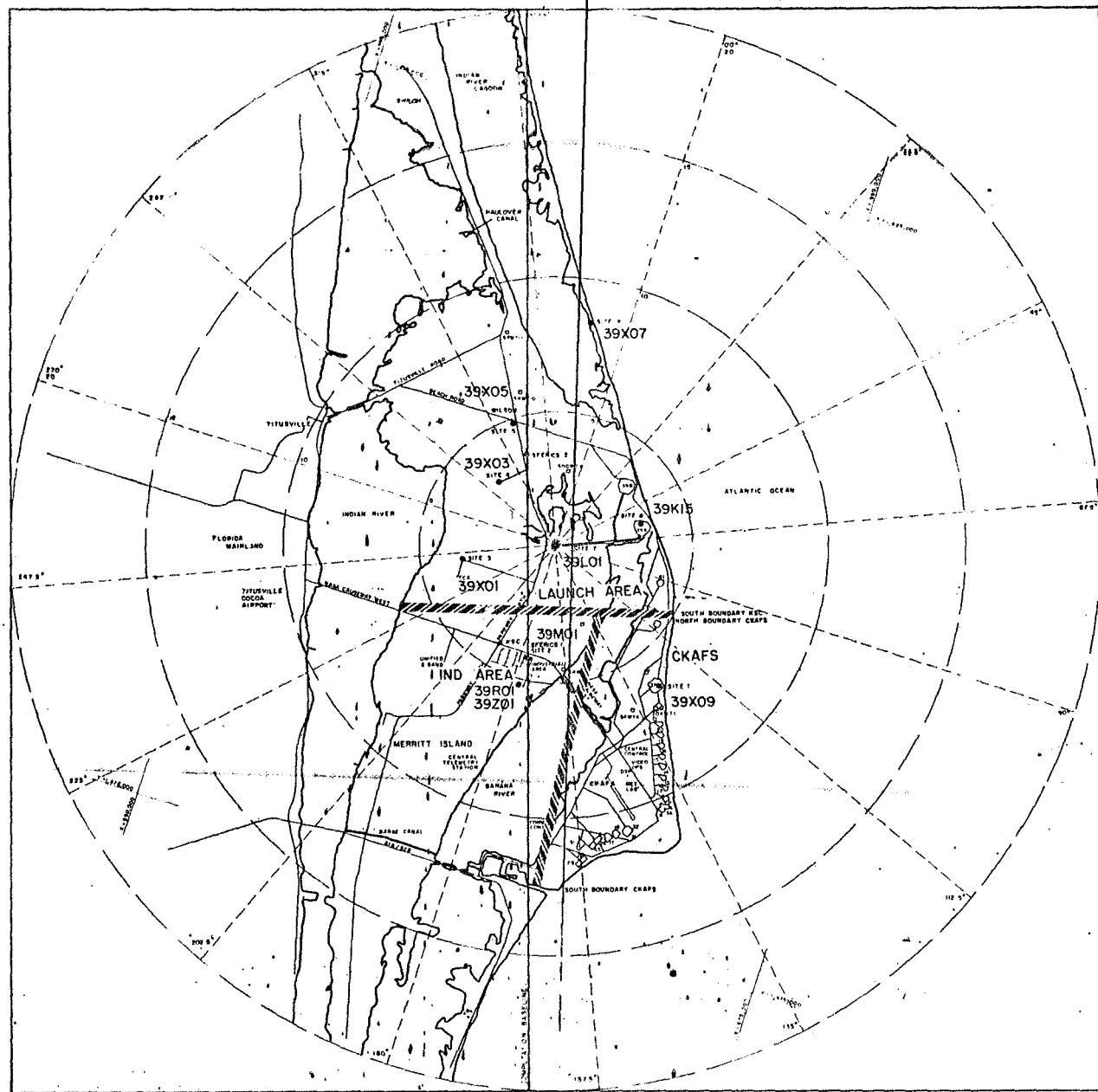


Figure 2-1. Area Boundaries and Measurement Station Locations

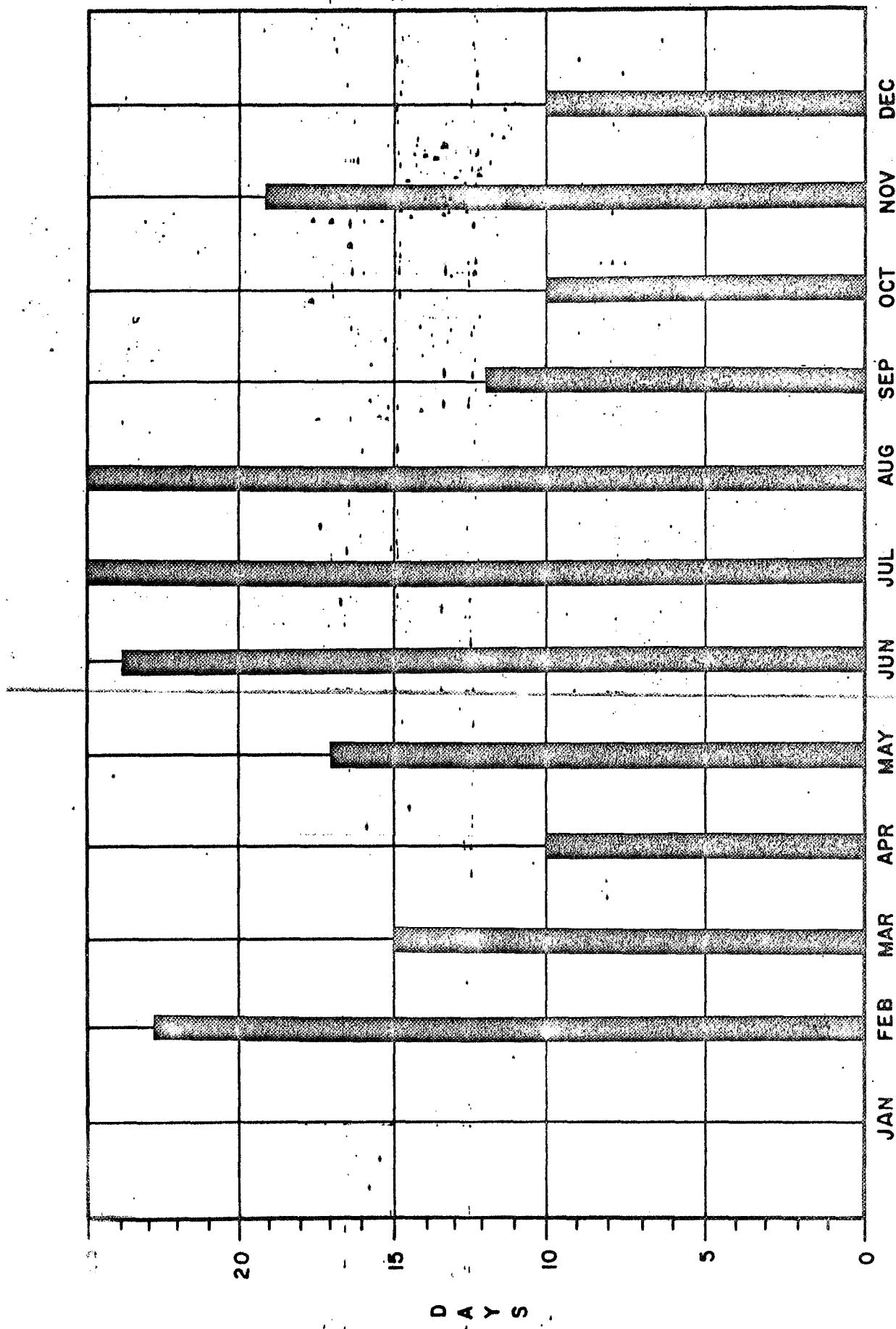
Table 2-1. Lightning Measurements

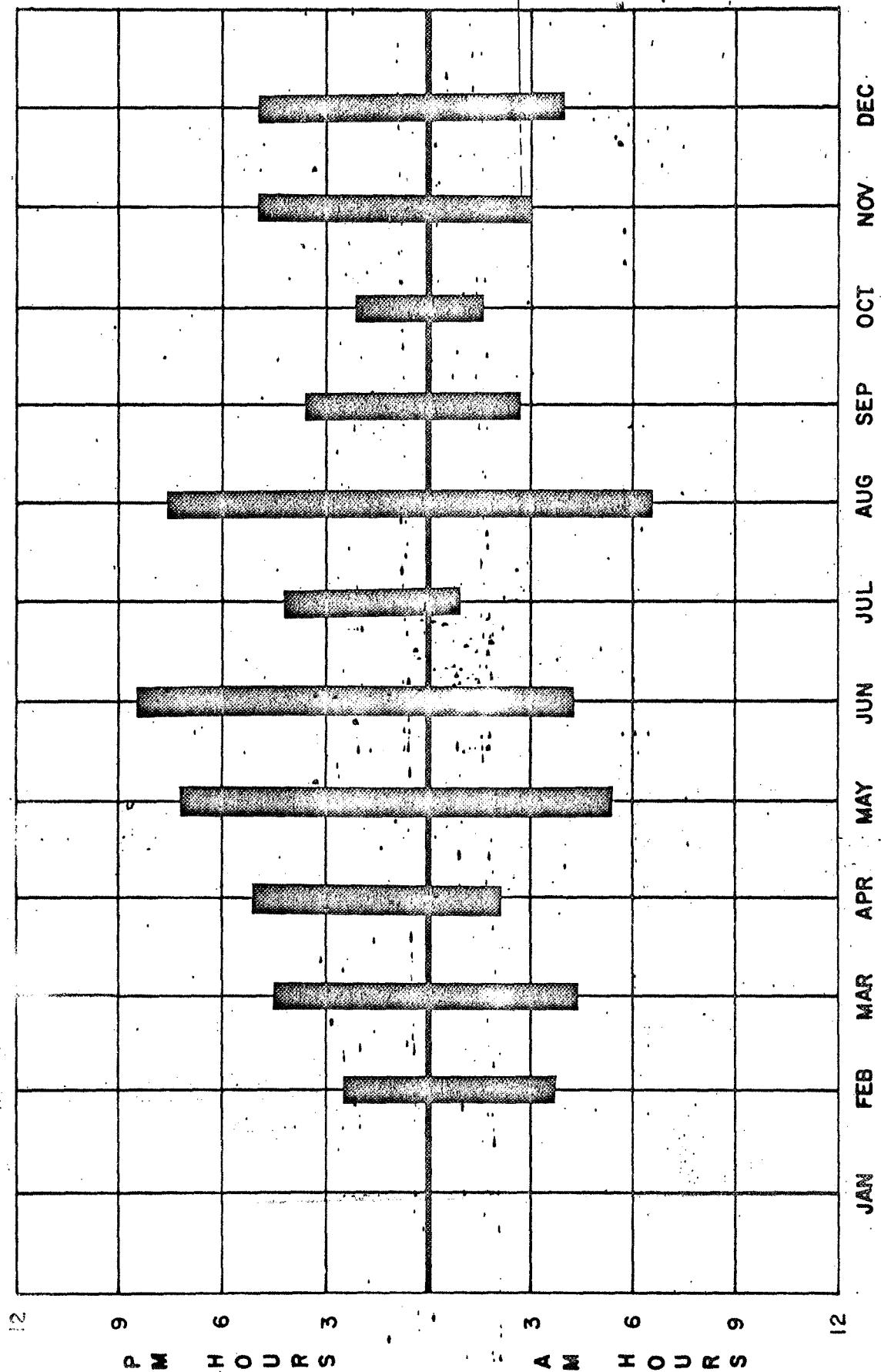
Location	Station	Activity Day Page No.	Activity Hour Page No.
Site 1, LC-37 Roof	39X09	2-5	2-6
Site 2, MSOB Roof	39M01	2-8	2-9
Near Site 2, Hypergolic Bldg 1	39R01	2-11	2-12
Near Site 2, Pyrotechnic Bldg	39Z01	2-14	2-15
Site 3, FCA Road	39X01	2-17	2-18
Site 4, Sharkey, Rd	39X03	2-20	2-21
Site 5, Wilson Intersection	39X05	2-23	2-24
Site 6, Playalinda	39X07	2-26	2-27
Site 7, VAB Roof	39L01	2-29	2-30
Site 8, LC-39 Pad A	39K15	2-32	2-33

Table 2-2. Summary of Measurement Station 39X09
at Site 1, LC-37 Blockhouse Roof

Month	Activity Days	
	Potential Gradient	Stroke
Jan	-	-
Feb	23	2
Mar	15	0
Apr	10	1
May	17	6
Jun	24	13
Jul	25	18
Aug	25	20
Sep.	12	8
Oct	10	4
Nov	19	5
Dec	10	4

Station 39X09. Potential Gradient Activity Days per Month
at Site 1, LC-37 Blockhouse Roof



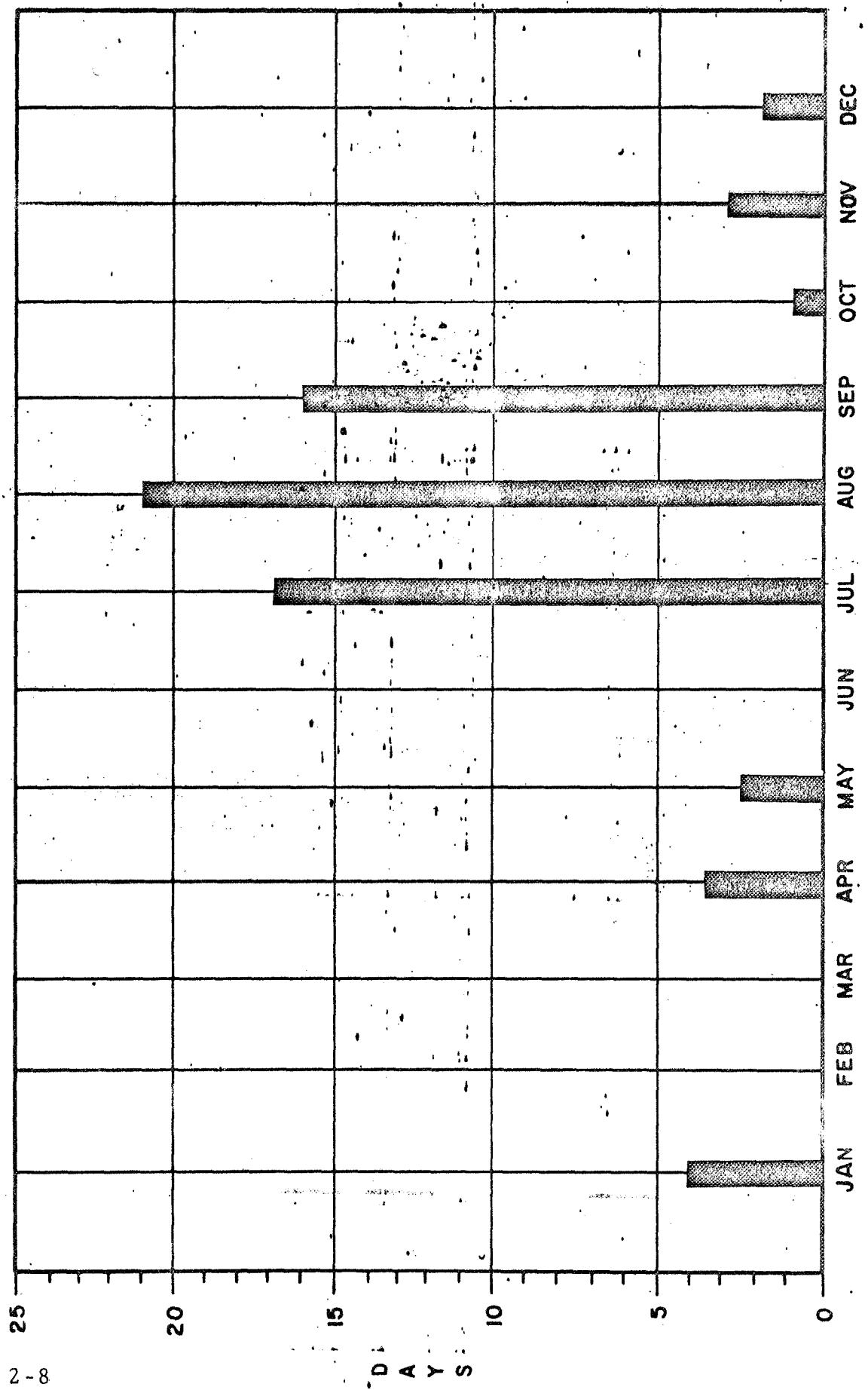


Station 39X09, AM and PM Distribution of Potential Gradient Activity Hours per Month at Site 1, LC-37 Blockhouse Roof

STATION 39X09

Table 2-3. Summary of Measurement Station 39M01
at Site Z, MSOB Roof

Month	Activity Days	
	Potential Gradient	Stroke
Jan	4	1
Feb	-	-
Mar	-	-
Apr	3	1
May	2	2
Jun	-	-
Jul	17	15
Aug	21	18
Sep	16	12
Oct	1	1
Nov	3	3
Dec	2	2



Station 39M01. AM and PM Distribution of Potential Gradient Activity Hours per Month at Site 2, MSOB Roof

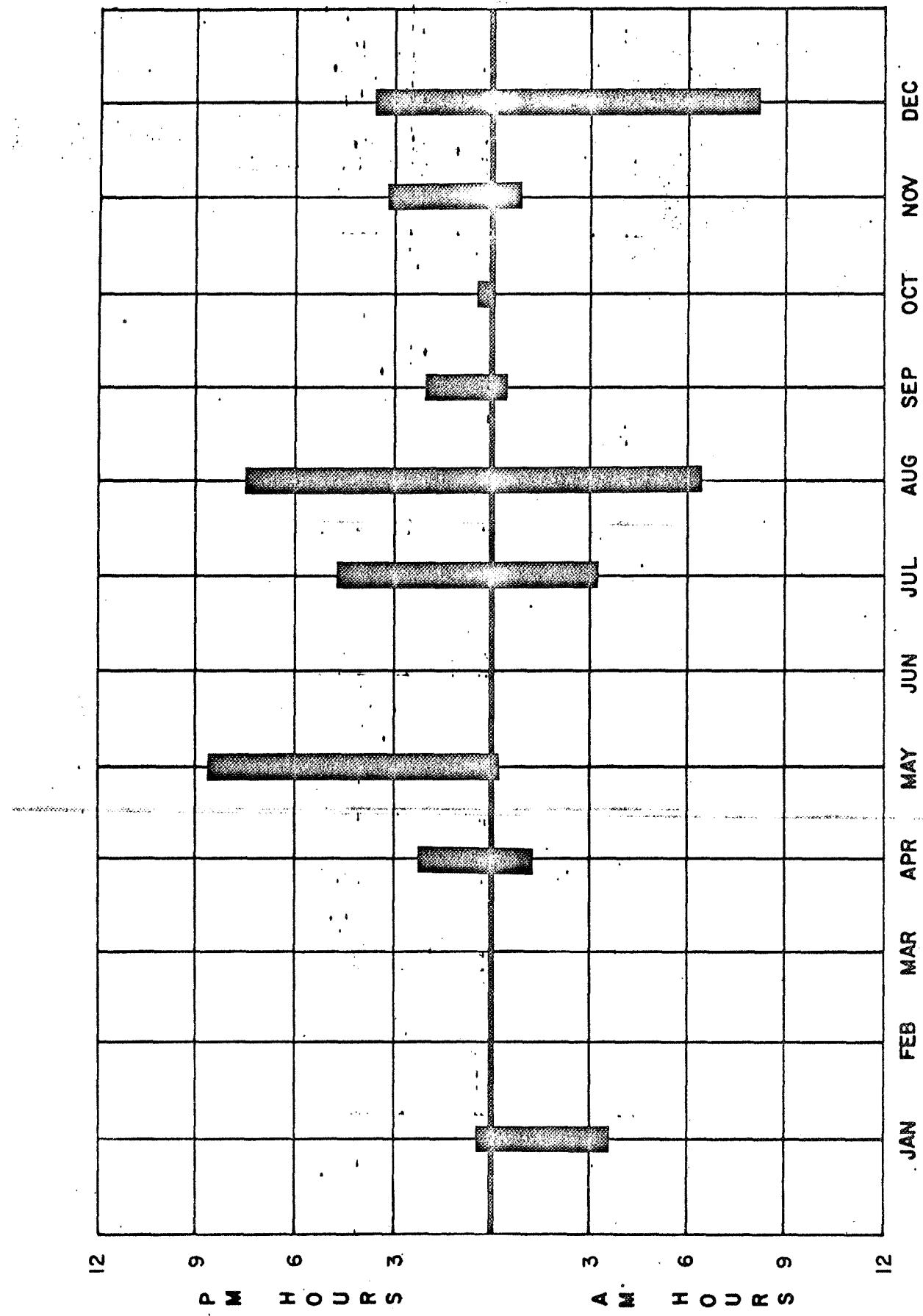
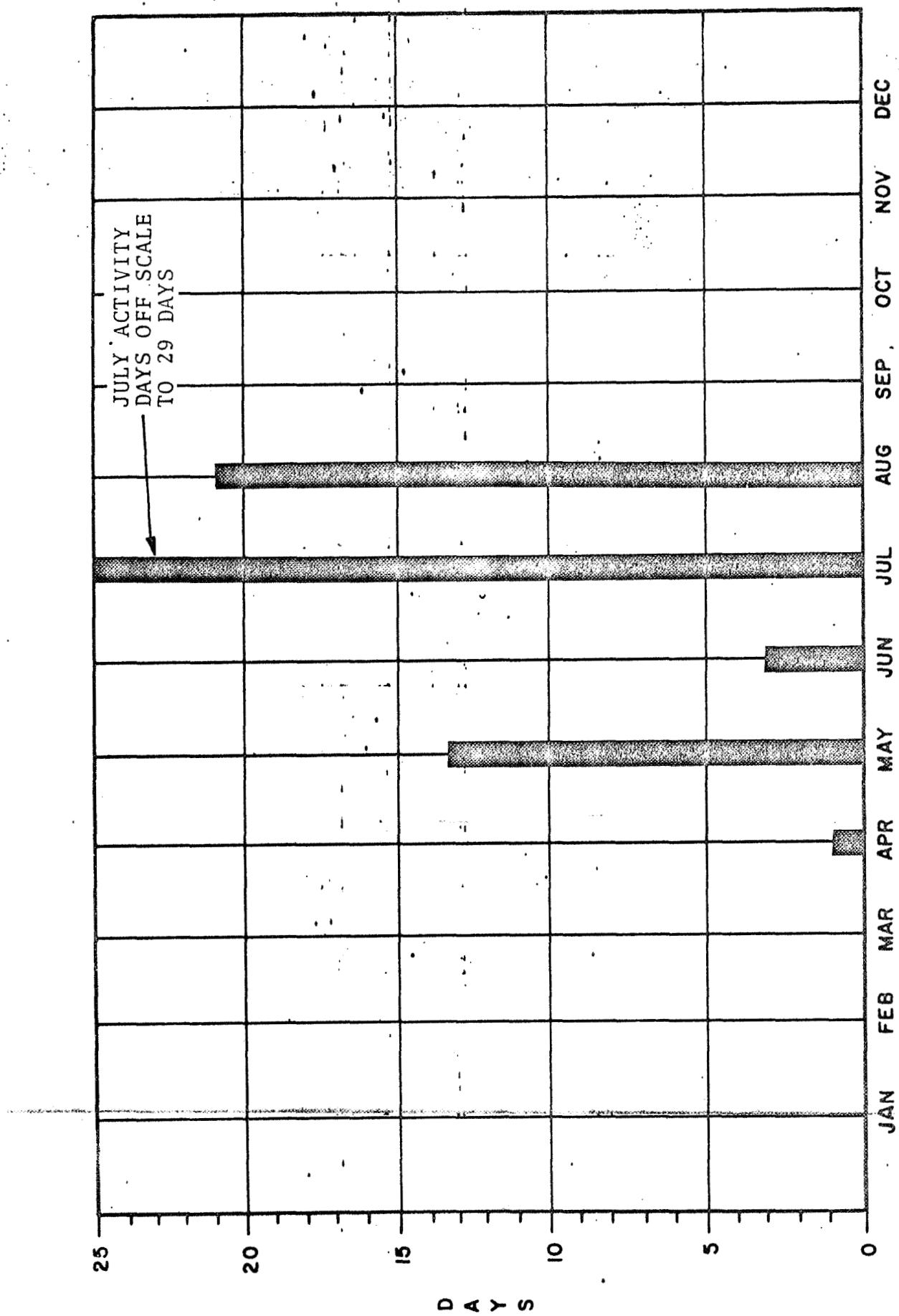
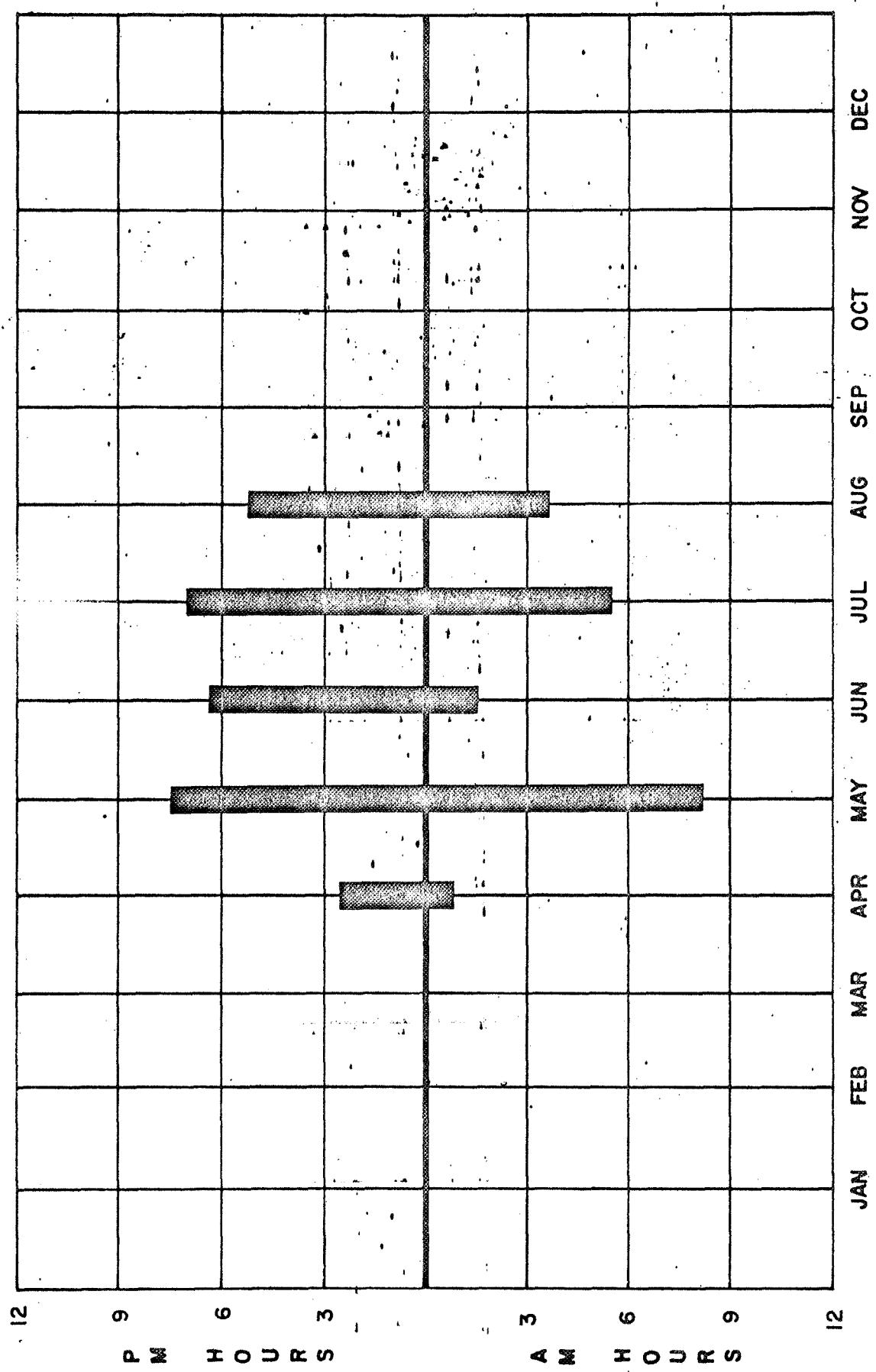


Table 2-4. Summary of Measurement Station 39R01
Near Site 2, Hypergolic Building 1

Month	Activity Days	
	Potential Gradient	Stroke
Jan	-	-
Feb	-	-
Mar	-	-
Apr	1	1
May	13	13
Jun	3	0
Jul	29	19
Aug	21	12
Sep	-	-
Oct	1	-
Nov	-	-
Dec	-	-



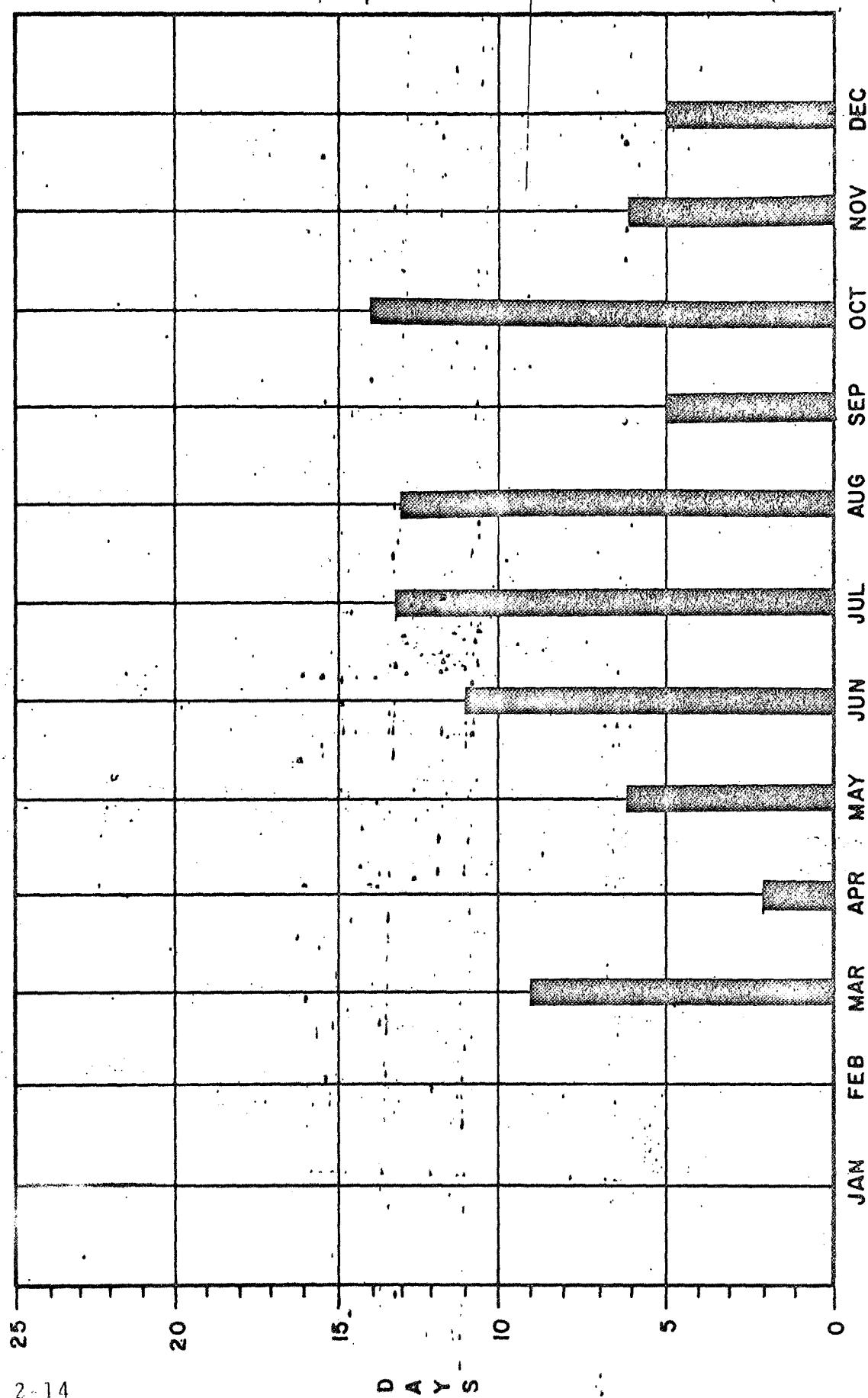
Station 39R01. Potential Gradient Activity Days per Month
Near Site 2, Hypergolic Building 1

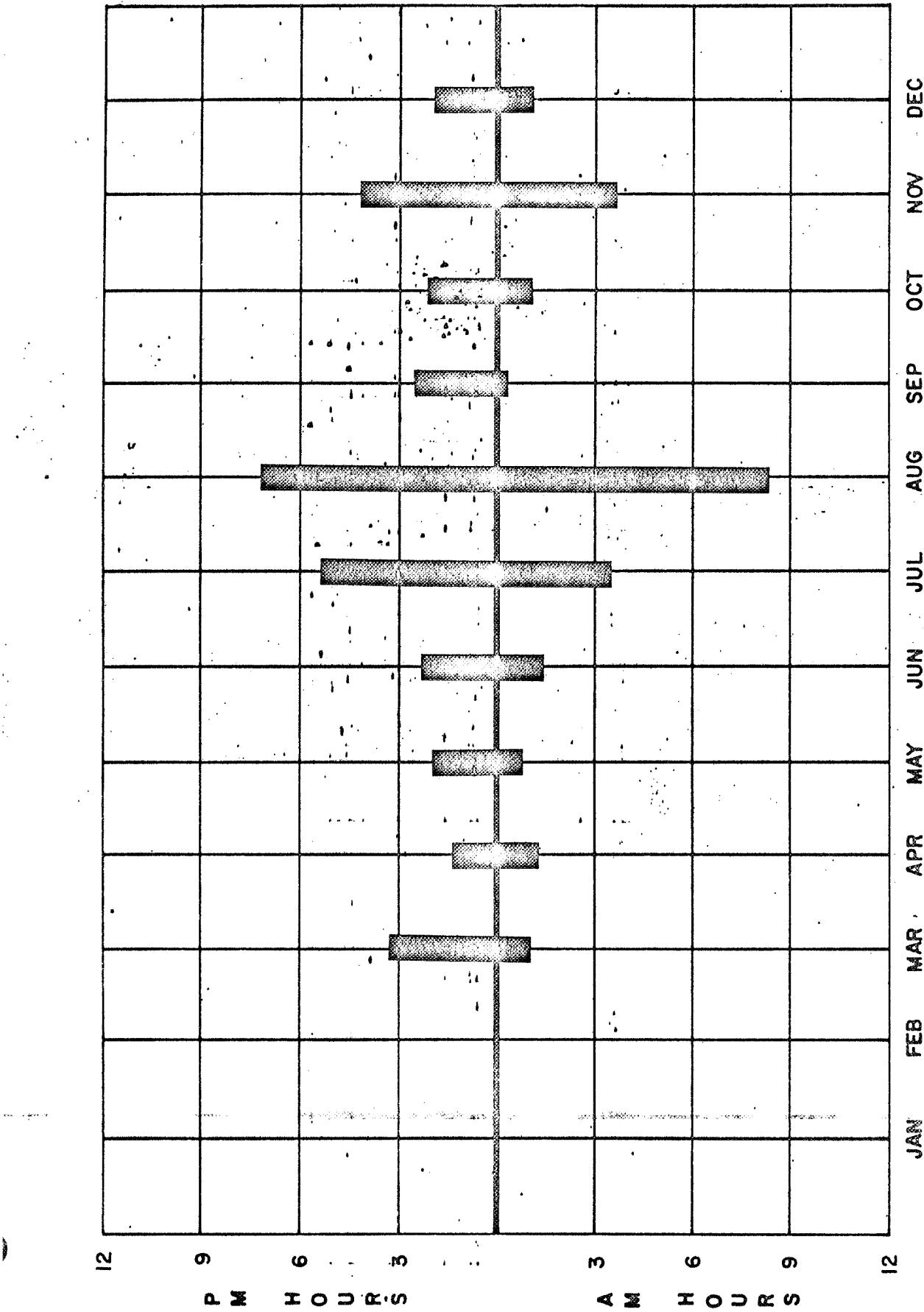


Station 39R01. AM and PM Distribution of Potential Gradient Activity Hours per Month Near Site 2, Hypergolic Building 1

Table 2-5: Summary of Measurement Station 39Z01
Near Site 2, Pyrotechnic Building

Month	Activity Days	
	Potential Gradient	Stroke
Jan	-	-
Feb	-	-
Mar	9	5
Apr	2	1
May	6	4
Jun	11	10
Jul	13	12
Aug	13	8
Sep	5	2
Oct	14	6
Nov	6	0
Dec	5	5

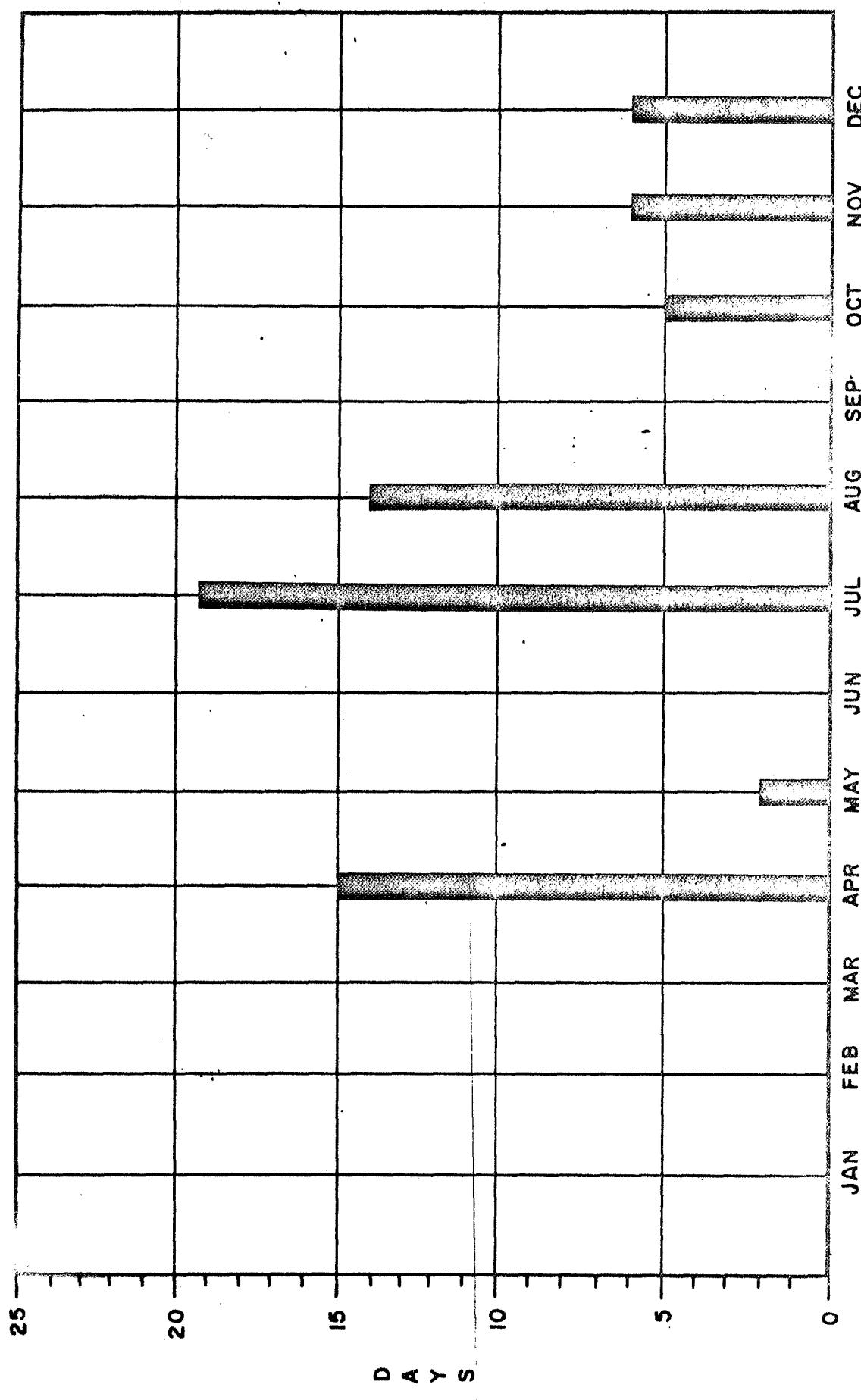


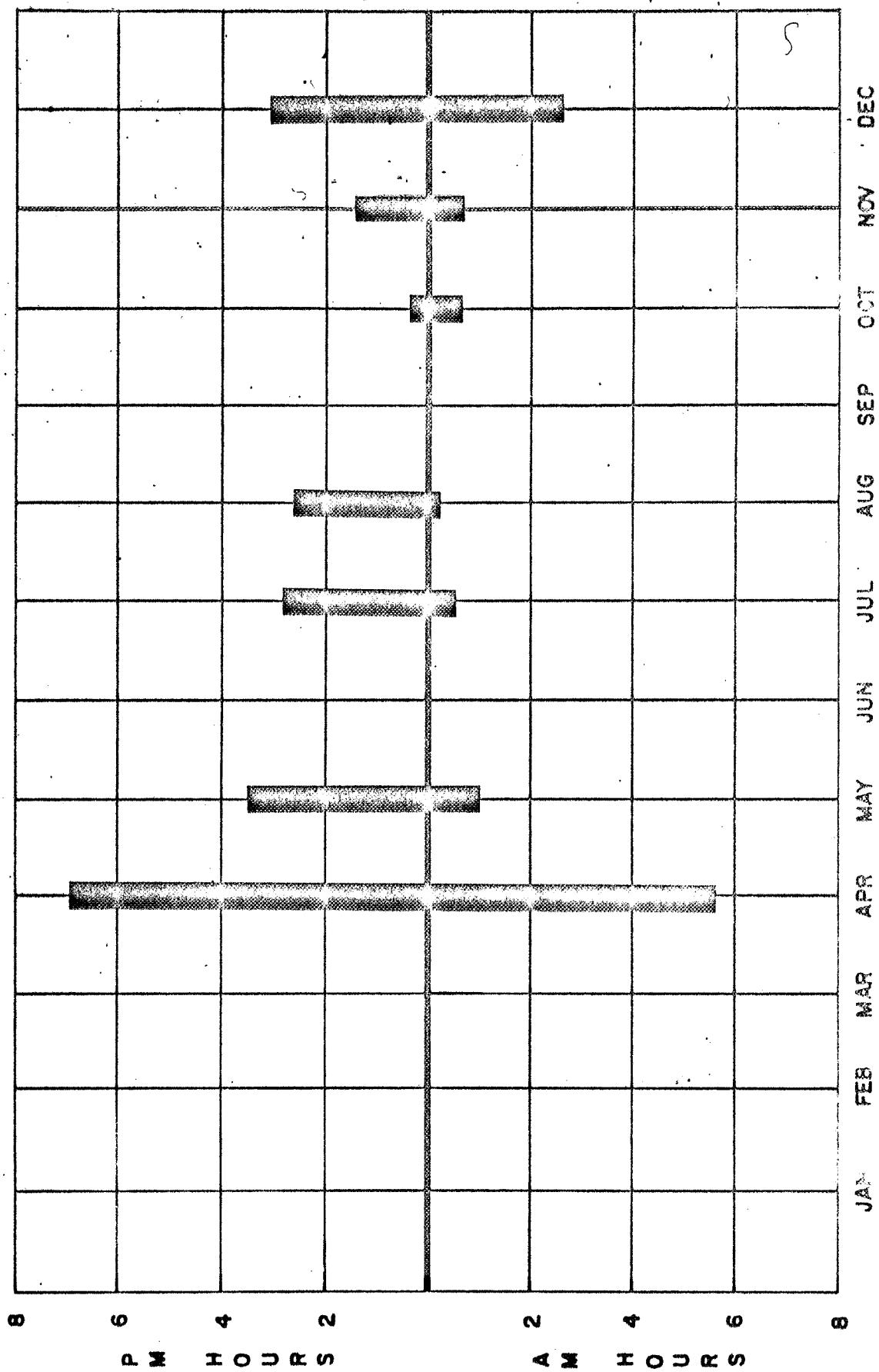


Station 39Z01. AM and PM Distribution of Potential Gradient Activity Hours per Month Near Site 2, Pyrotechnic Building

Table 2-6. Summary of Measurement Station 39X01
at Site 3, FCA Road

Month	Activity Days	
	Potential Gradient	Stroke
Jan	-	-
Feb	-	-
Mar	-	-
Apr	15	0
May	2	2
Jun	-	-
Jul	19	13
Aug	14	14
Sep	-	-
Oct	5	1
Nov	6	4
Dec	6	5

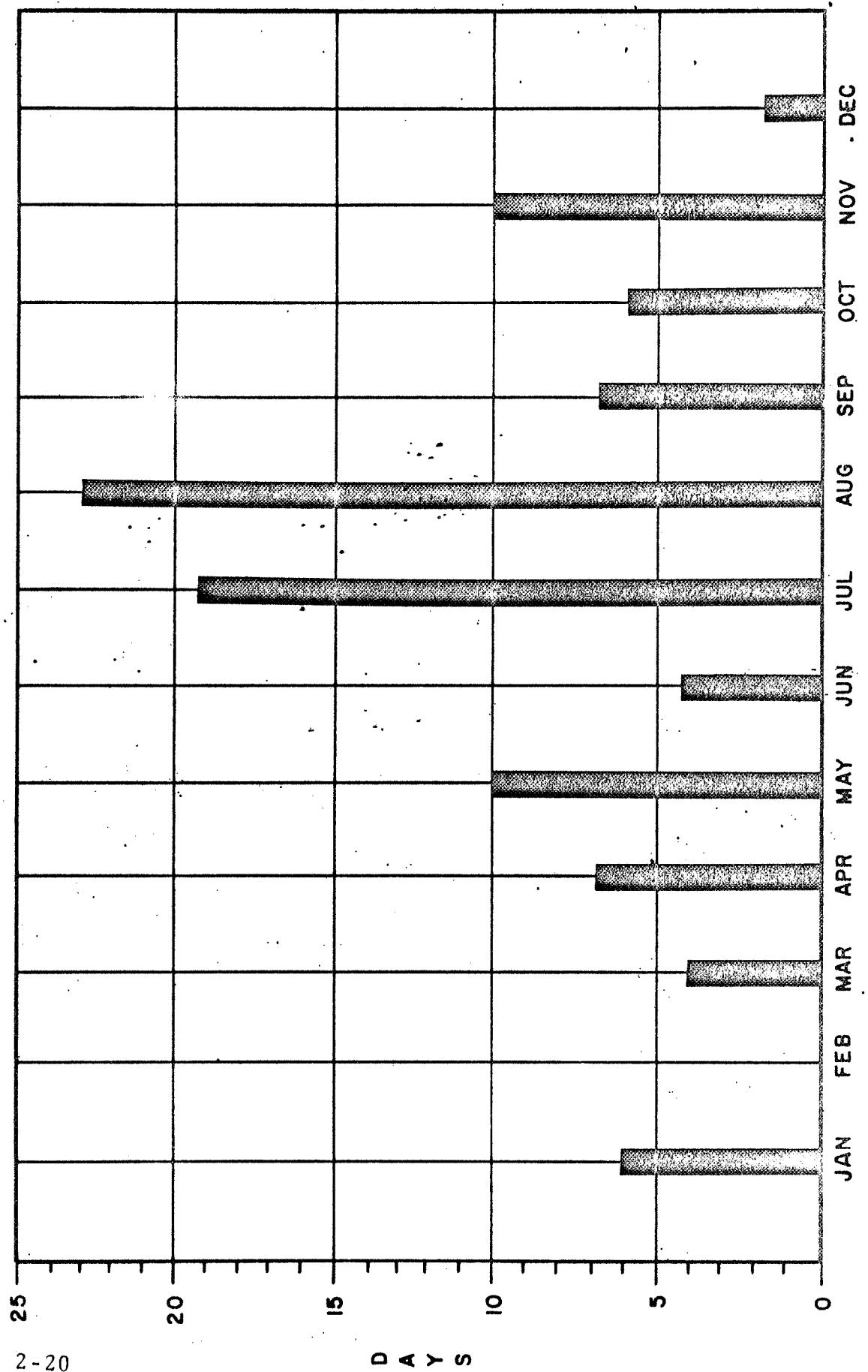




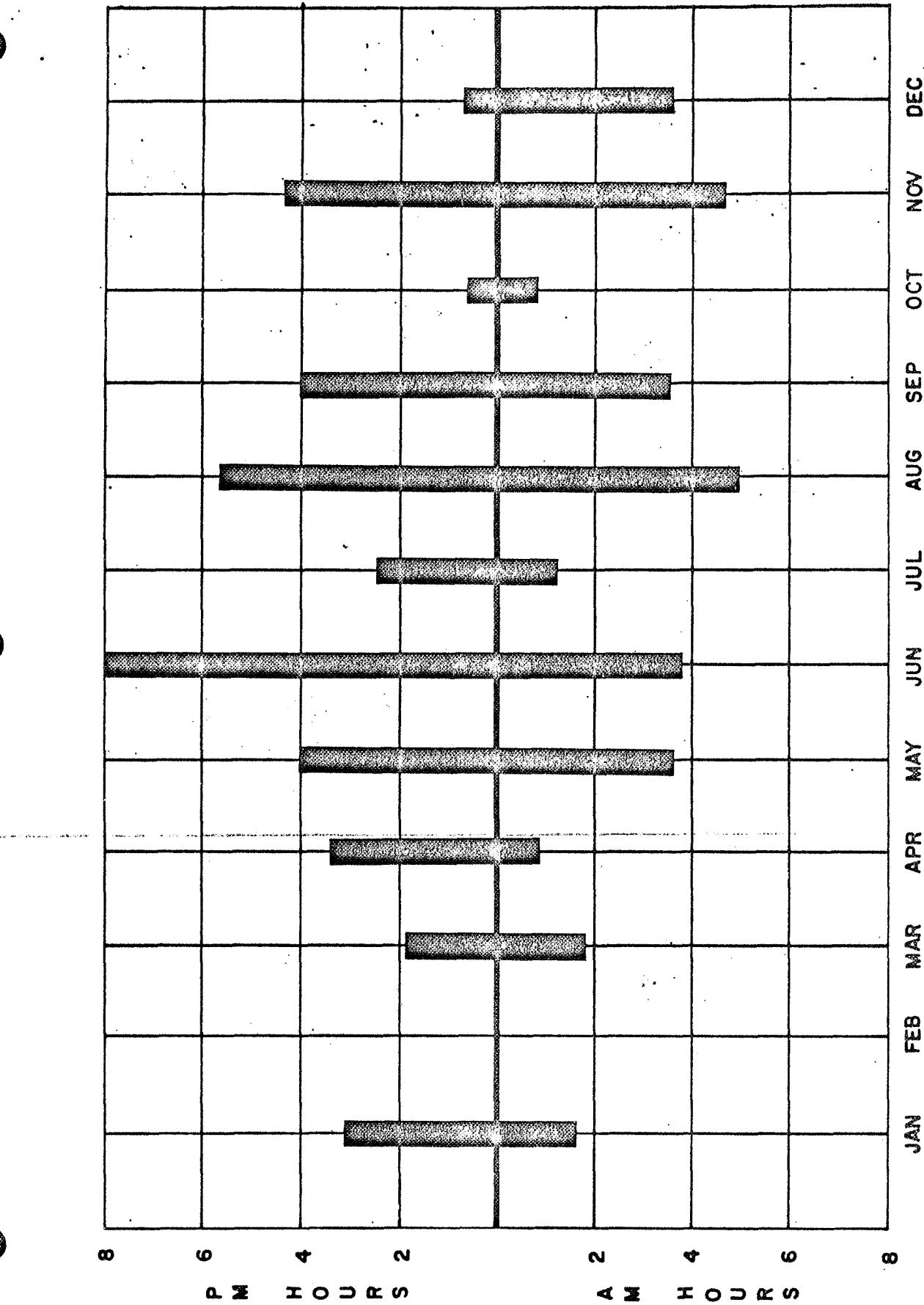
Station 39X01. AM and PM Distribution of Potential Gradient Activity Hours
per Month at Site 3, FCA Road

Table 2-7. Summary of Measurement Station 39X03
at Site 4, Sharkey Road

Month	Activity Days	
	Potential Gradient	Stroke
Jan	6	-
Feb	-	-
Mar	4	4
Apr	7	2
May	10	4
Jun	4	2
Jul	19	16
Aug	23	16
Sep	7	4
Oct	6	3
Nov	10	4
Dec	2	1



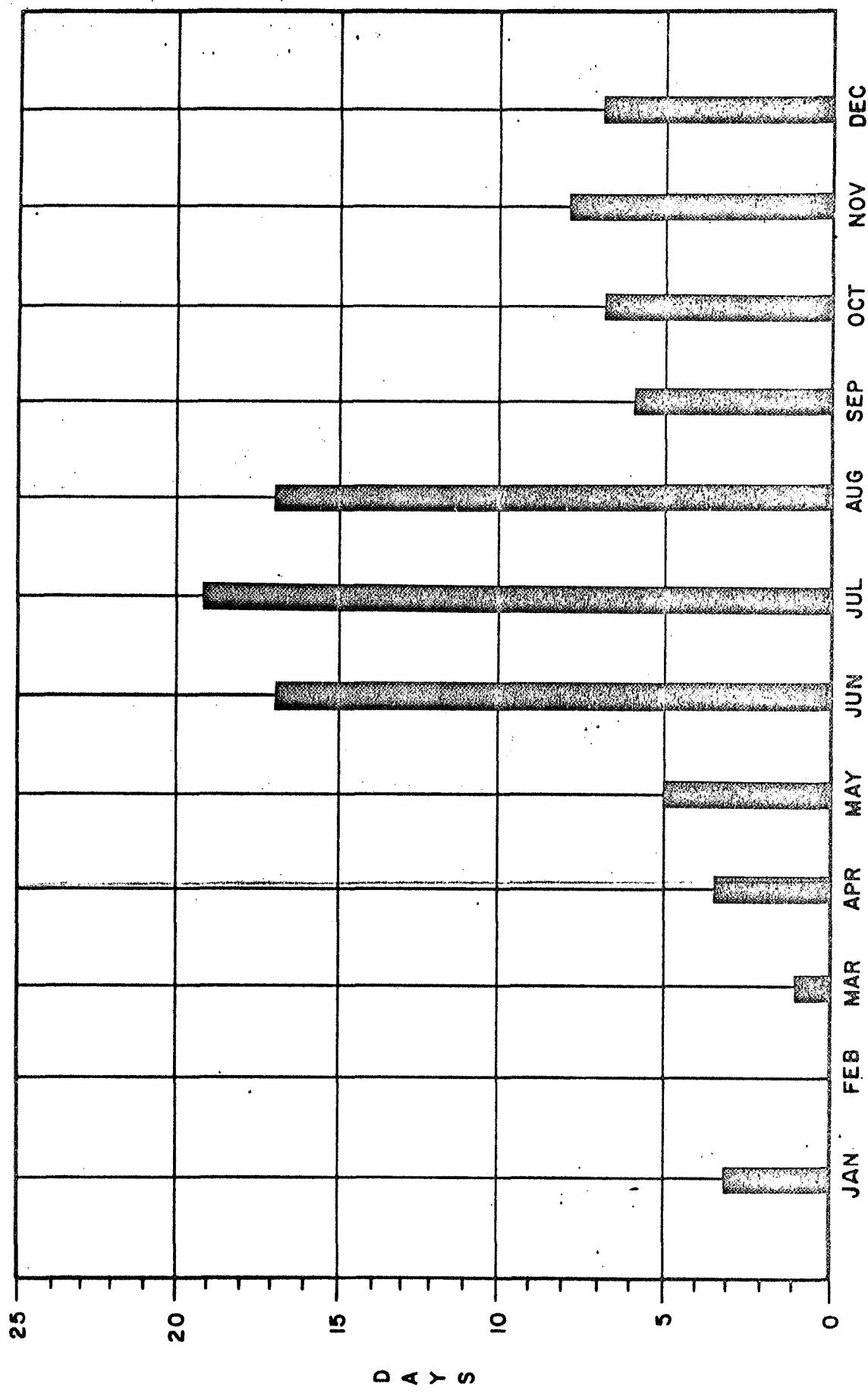
Station 39X03. Potential Gradient Activity Days per Month
at Site 4, Sharkey Road



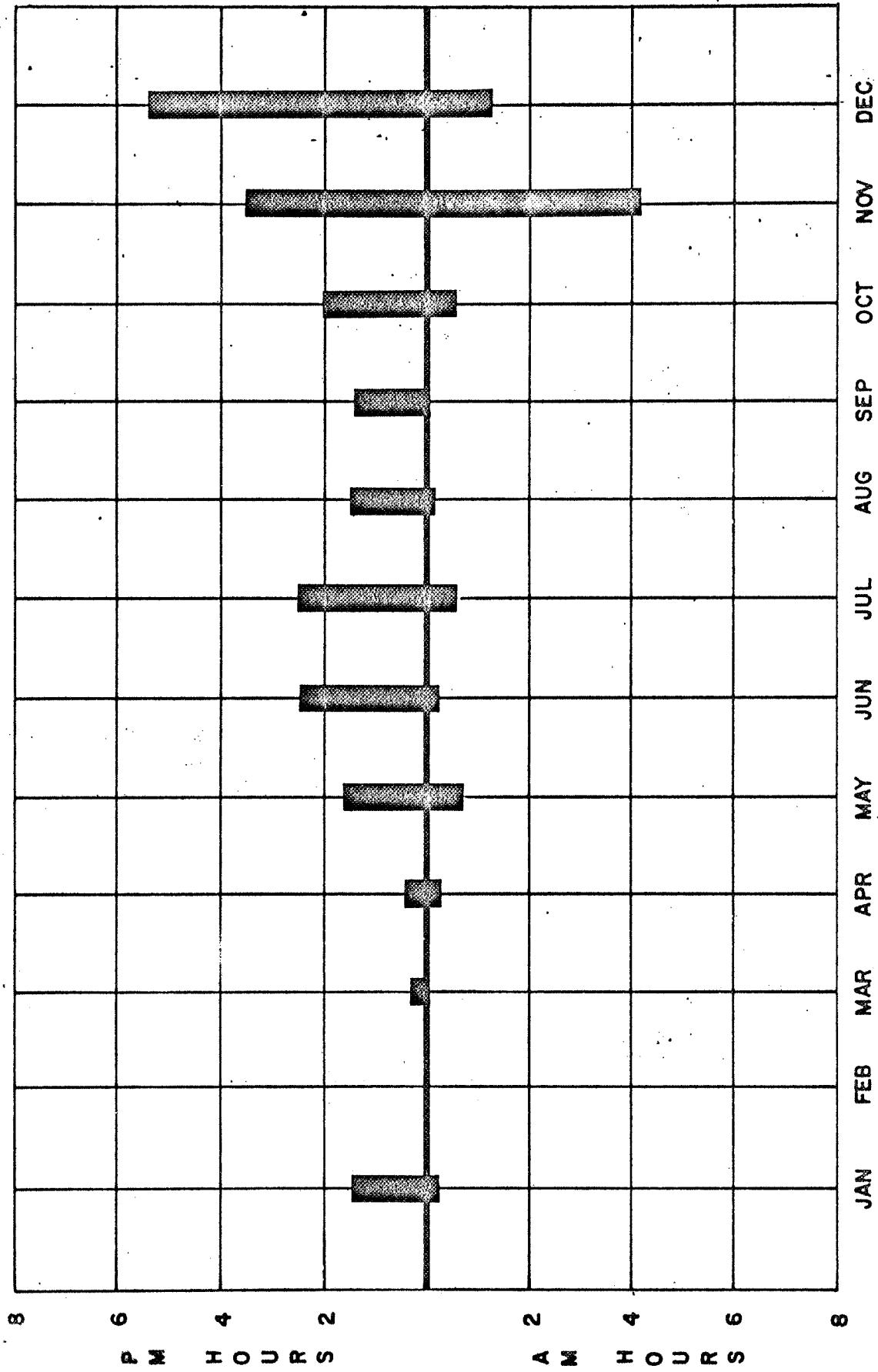
Station 39X03: AM and PM Distribution of Potential Gradient Activity Hours per Month at Site 4, Sharkey Road

Table 2-8. Summary of Measurement Station 39X05
at Site 5, Wilson Intersection

Month	Activity Days	
	Potential Gradient	Stroke
Jan	3	0
Feb	-	-
Mar	1	0
Apr	3	1
May	5	2
Jun	17	8
Jul	19	12
Aug	17	12
Sep	6	2
Oct	7	3
Nov	8	4
Dec	7	2



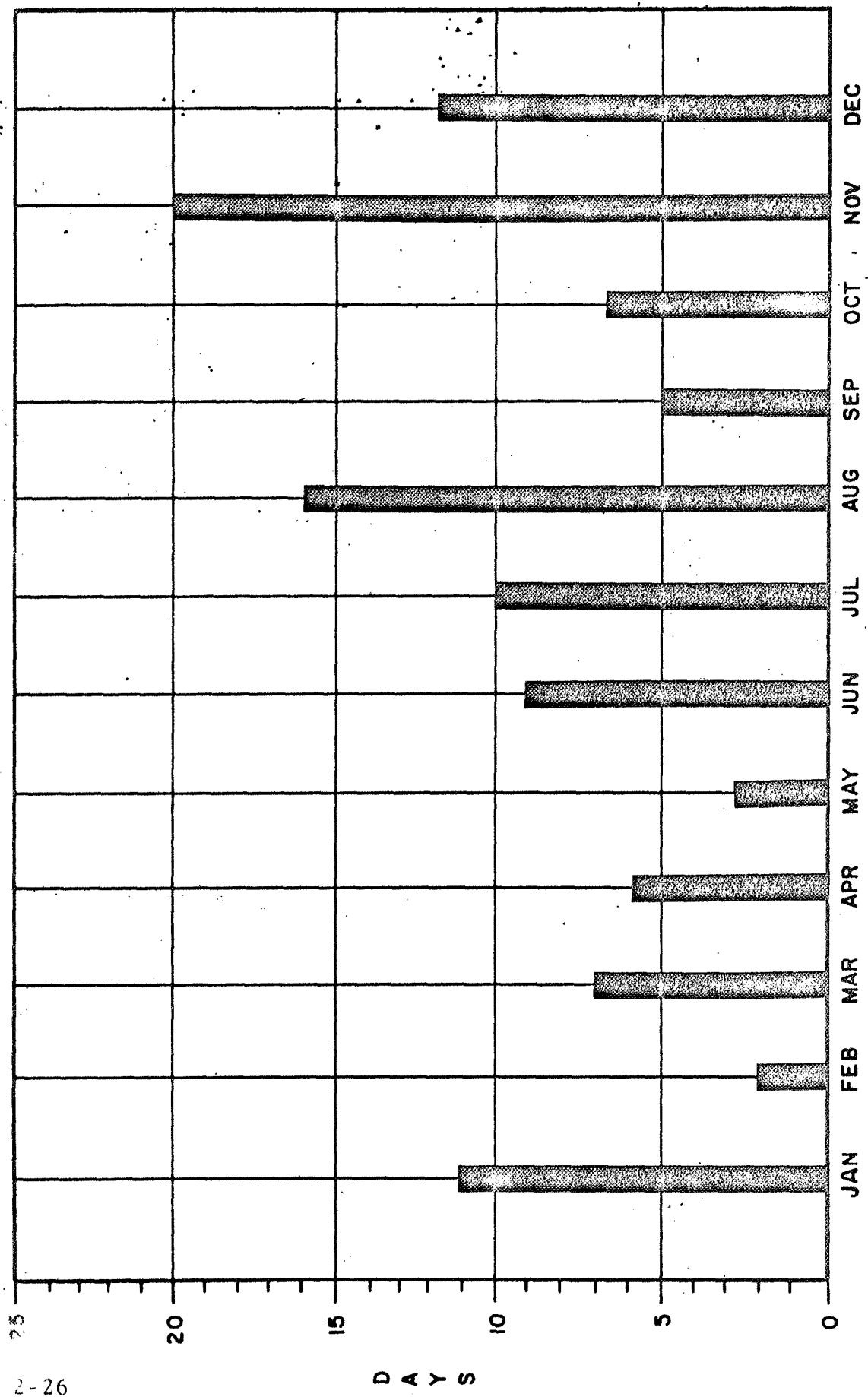
Station 39X05. Potential Gradient Activity Days per Month
at Site 5, Wilson Intersection

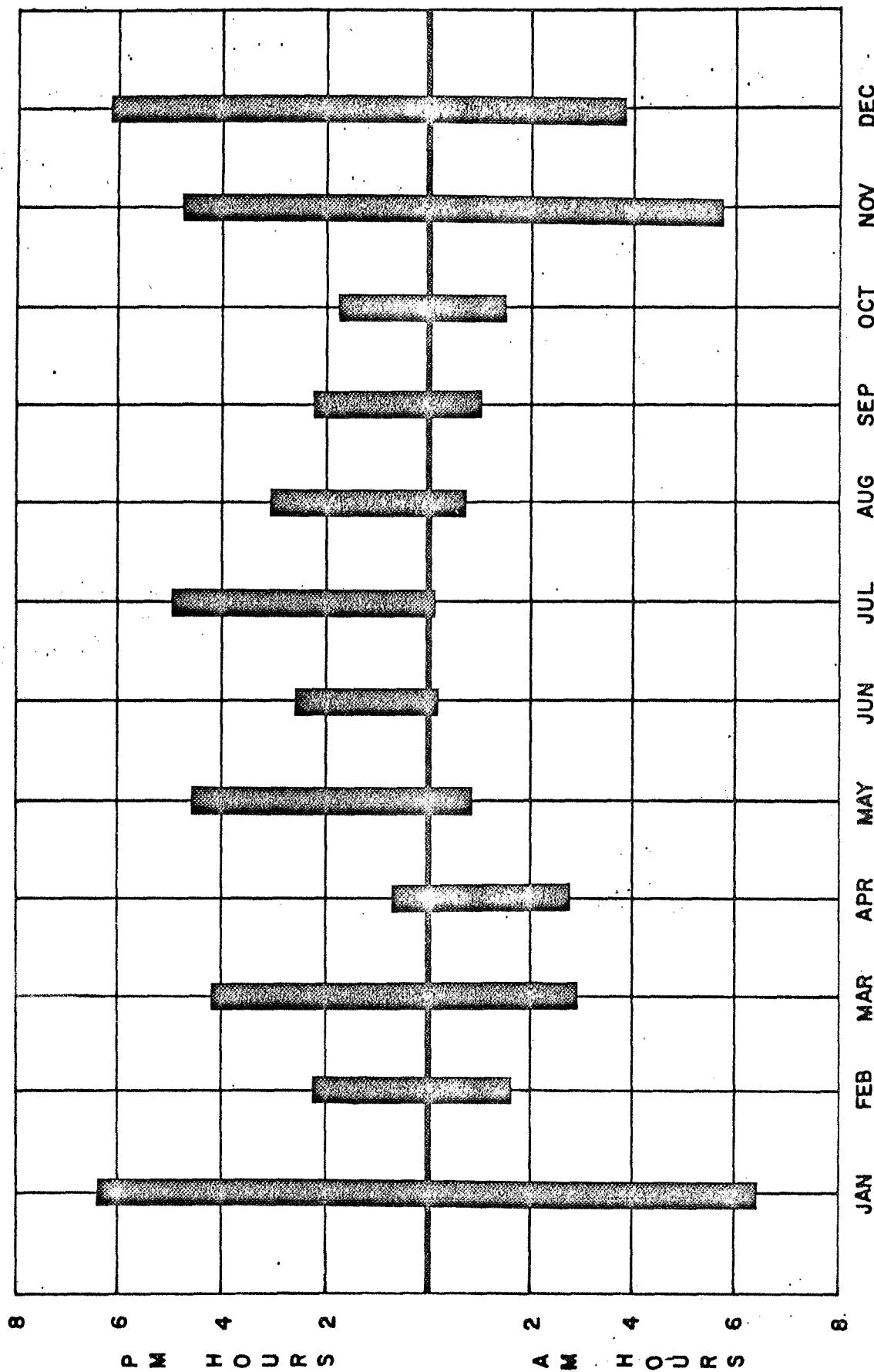


Station 39X05. AM and PM Distribution of Potential Gradient Activity Hours per Month at Site 5, Wilson Intersection

Table 2-9. Summary of Measurement Station 39X07
at Site 6, Playalinda

Month	Activity Days	
	Potential Gradient	Stroke
Jan	11	1
Feb	2	1
Mar	7	4
Apr	6	0
May	3	2
Jun	9	2
Jul	10	10
Aug	16	3
Sep	5	4
Oct	7	4
Nov	20	1
Dec	12	2

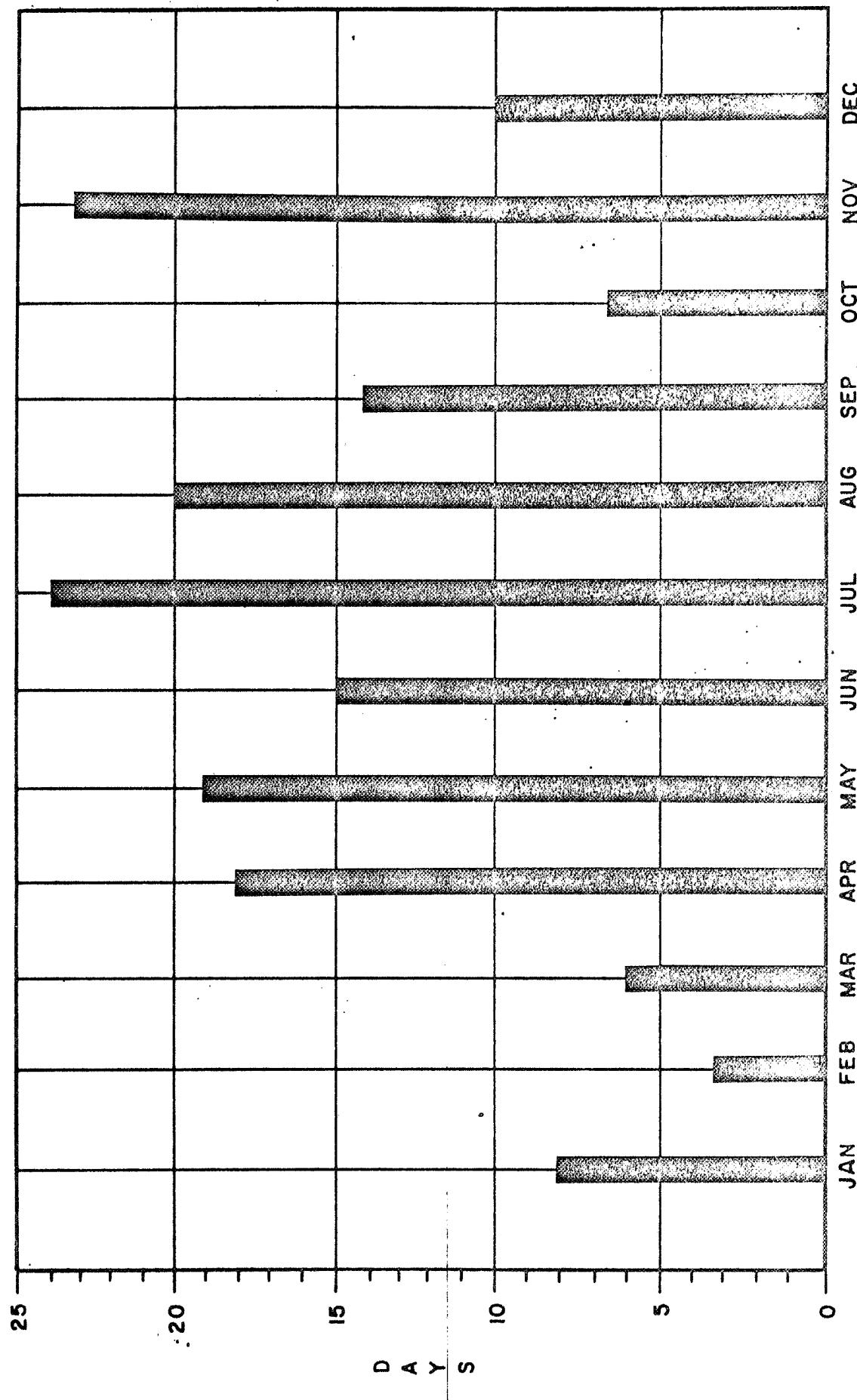


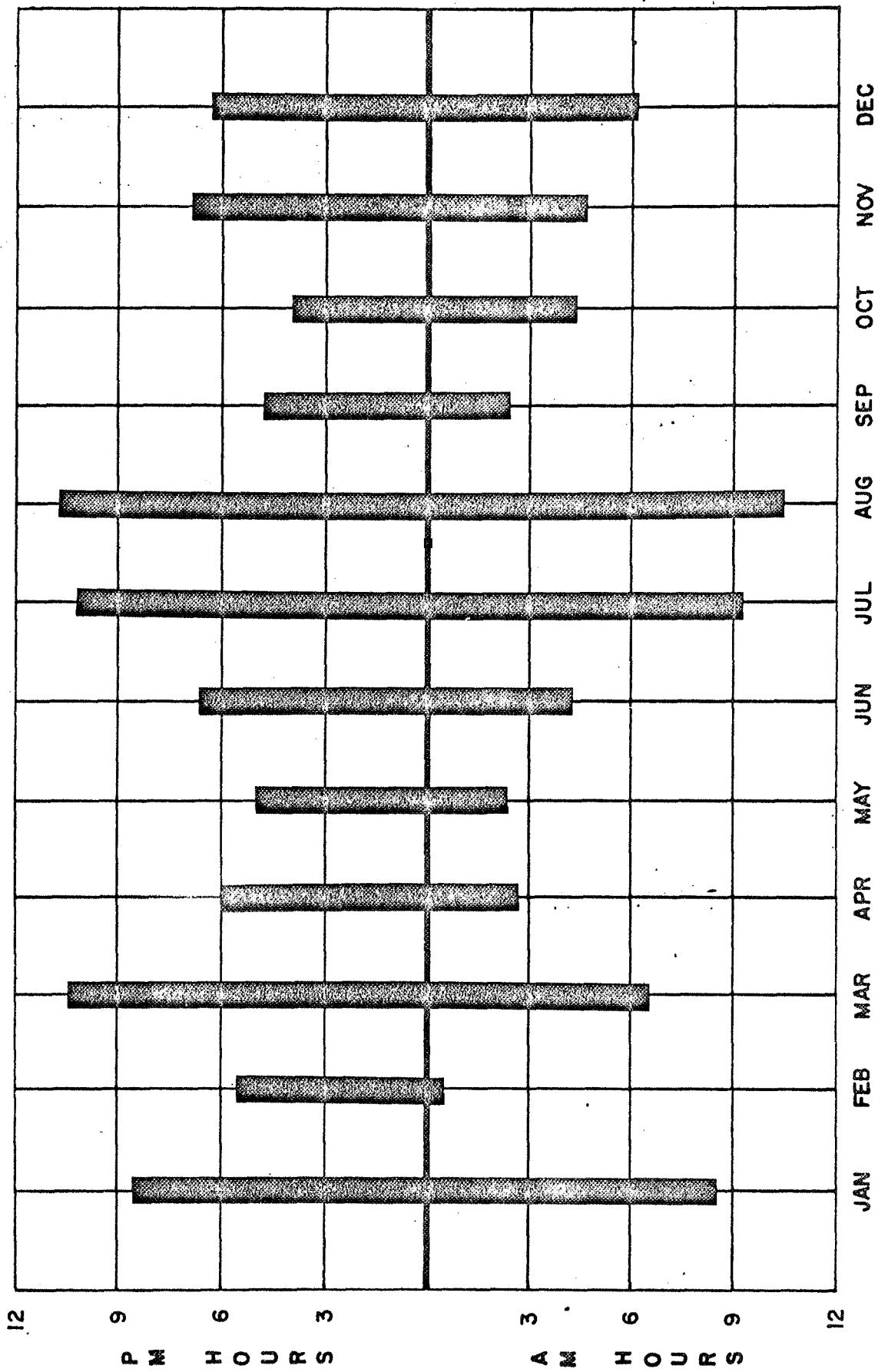


Station 39X07. AM and PM Distribution of Potential Gradient Activity Hours per Month at Site 6, Playalinda

Table 2-10. Summary of Measurement Station 39L01
at Site 7, VAB Roof

Month	Activity Days	
	Potential Gradient	Stroke
Jan	8	2
Feb	3	0
Mar	6	2
Apr	18	0
May	19	2
Jun	15	4
Jul	24	19
Aug	20	14
Sep	14	11
Oct	7	1
Nov	23	3
Dec	10	2

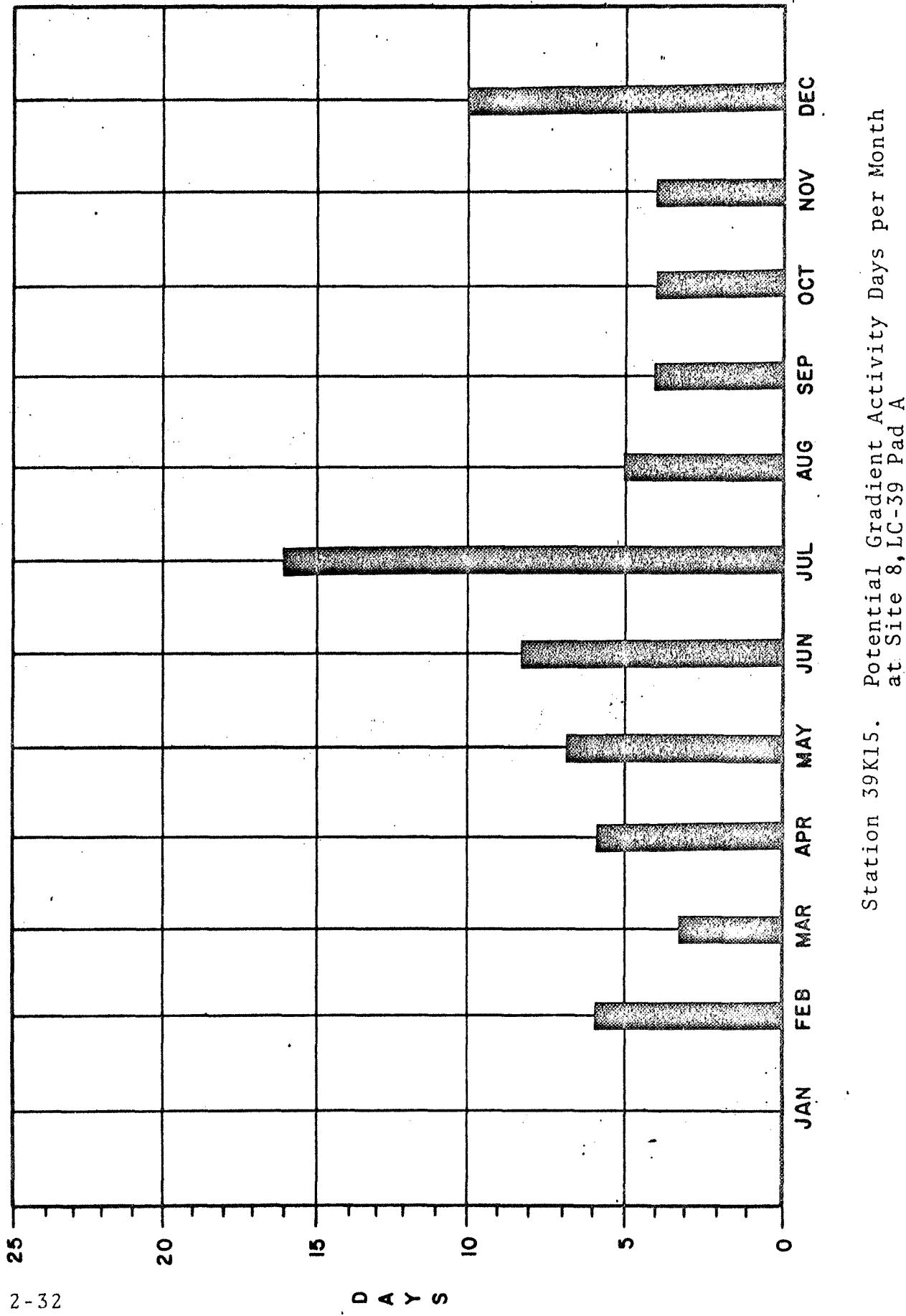


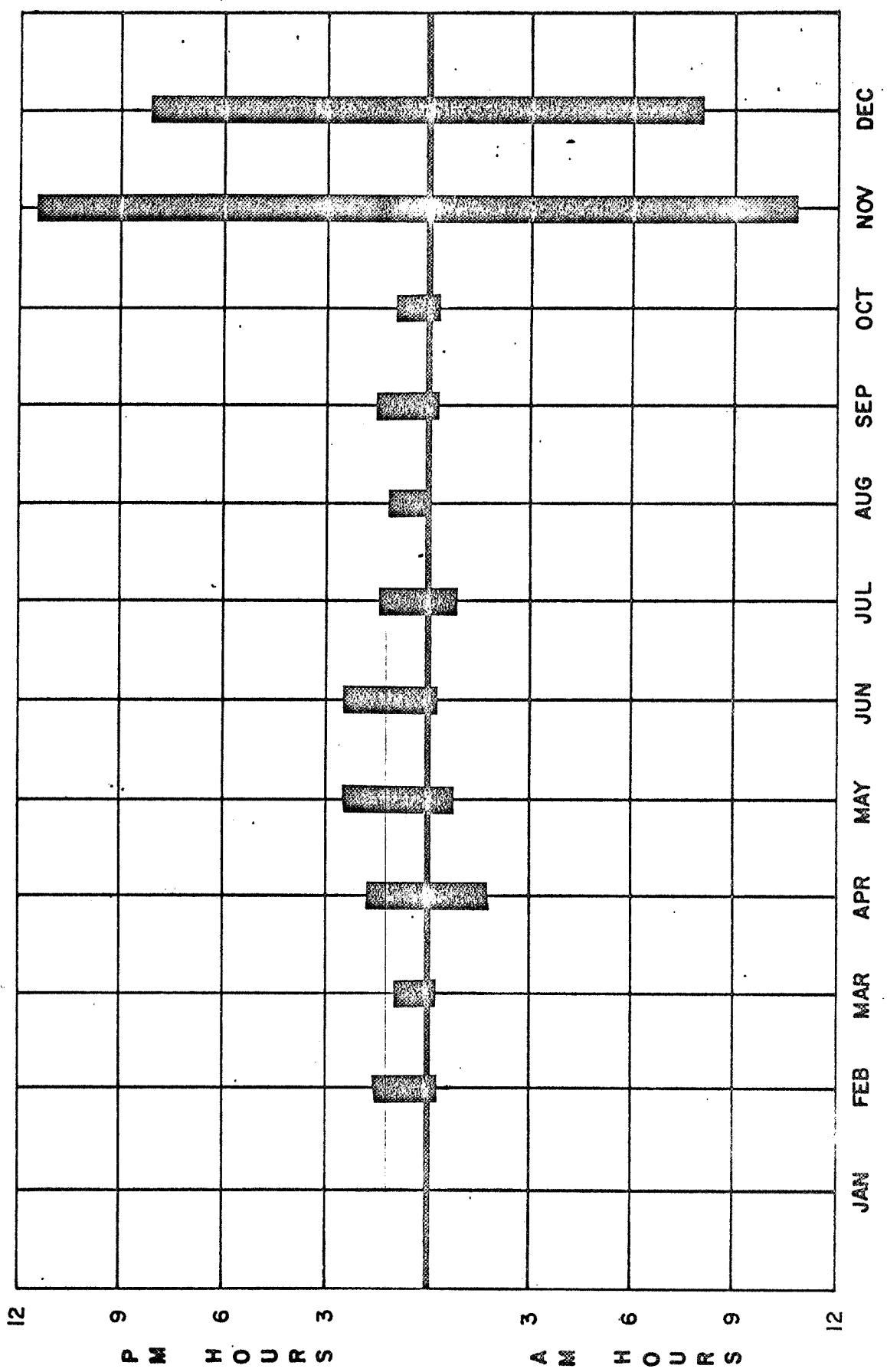


Station 39L01. AM and PM Distribution of Potential Gradient Activity Hours per Month at Site 7, VAB Roof

Table 2-11. Summary of Measurement Station 39K15
at Site 8, LC-39 Pad A

Month	Activity Days	
	Potential Gradient	Stroke
Jan	-	-
Feb	6	6
Mar	3	0
Apr	6	1
May	7	6
Jun	8	4
Jul	16	5
Aug	5	3
Sep	4	3
Oct	4	4
Nov	4	3
Dec	10	3





Station 39K15. AM and PM Distribution of Potential Gradient Activity Hours per Month at Site 8, LC-39 Pad A

SECTION III

LIGHTNING SUMMARY

A. GENERAL

This section presents a compilation of lightning activity recorded during the time periods of 1903 through 1924, 1957 through 1962 and 1964 through 1969.

B. ALEXANDER RECORDS 1903-1924

Table 3-1 lists lightning activity data taken from the Alexander records (ref 1) for the period 1903 through 1924.

Table 3-1. Data for 1903-1924

Month	Average Activity Days
Jan	0.0
Feb	1.5
Mar	2.0
Apr	3.0
May	7.0
Jun	12.0
Jul	15.0
Aug	17.5
Sep	12.5
Oct	3.3
Nov	0.8
Dec	1.0

C. ISOKERAUNIC DATA 1957-1962

An isokeraunic level is an index of the number of thunder-storm days per year as defined by days on which thunder was heard. Table 3-2 lists the isokeraunic levels at Patrick AFB from 1957 through 1962 (ref 2).

Table 3-2. Data for 1957-1962

Month	Average Activity Days
Jan	0.5
Feb	1.8
Mar	3.7
Apr	3.3
May	6.7
Jun	14.0
Jul	13.8
Aug	15.8
Sep	10.8
Oct	3.8
Nov	0.7
Dec	0.7

Figure 3-1 is an example of an isokeraunic map of the United States (ref 3). As shown, the incidence of lightning activity varies throughout the states being lowest at the Canadian border and Pacific coast and highest over the gulf coast of Florida.

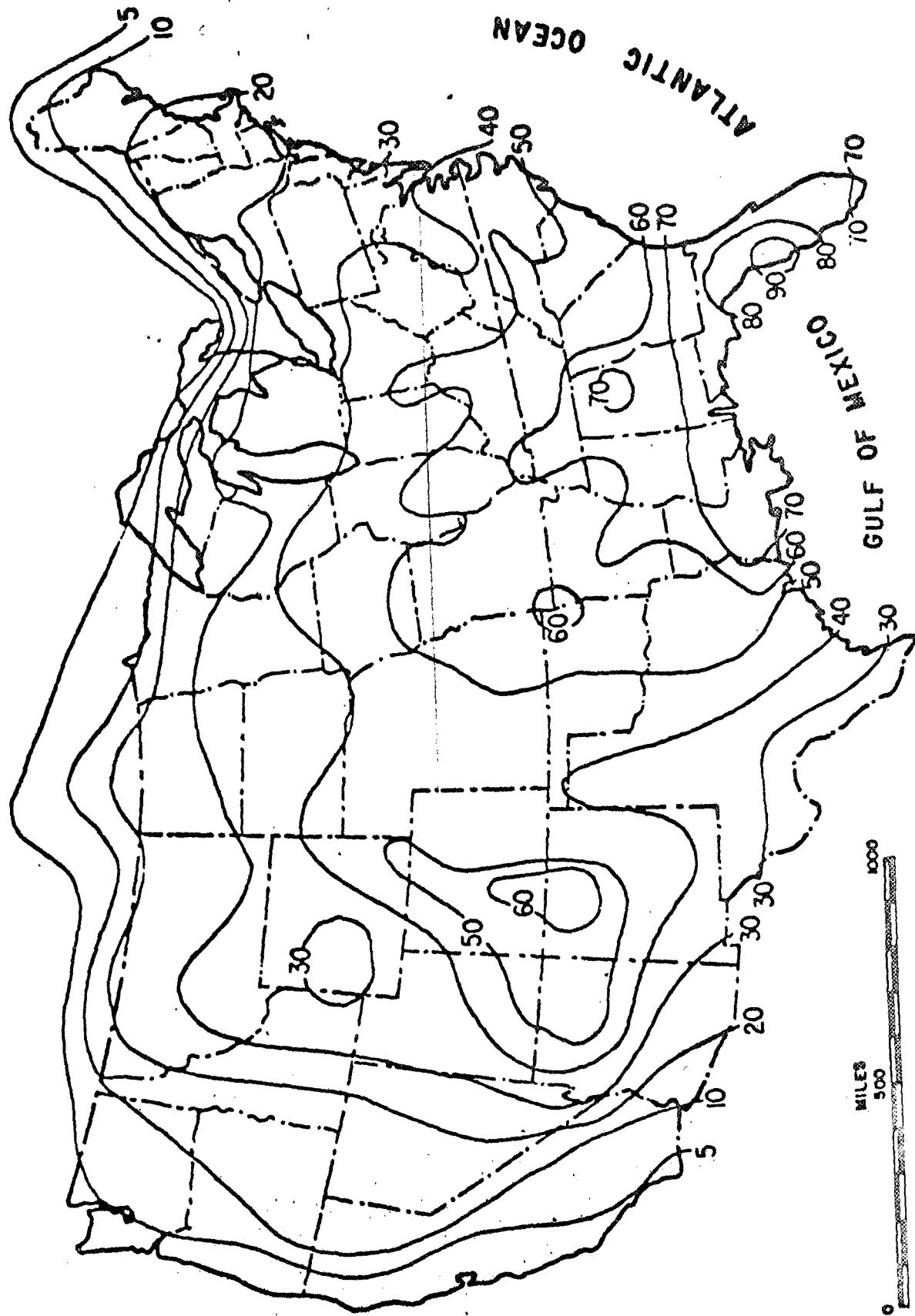


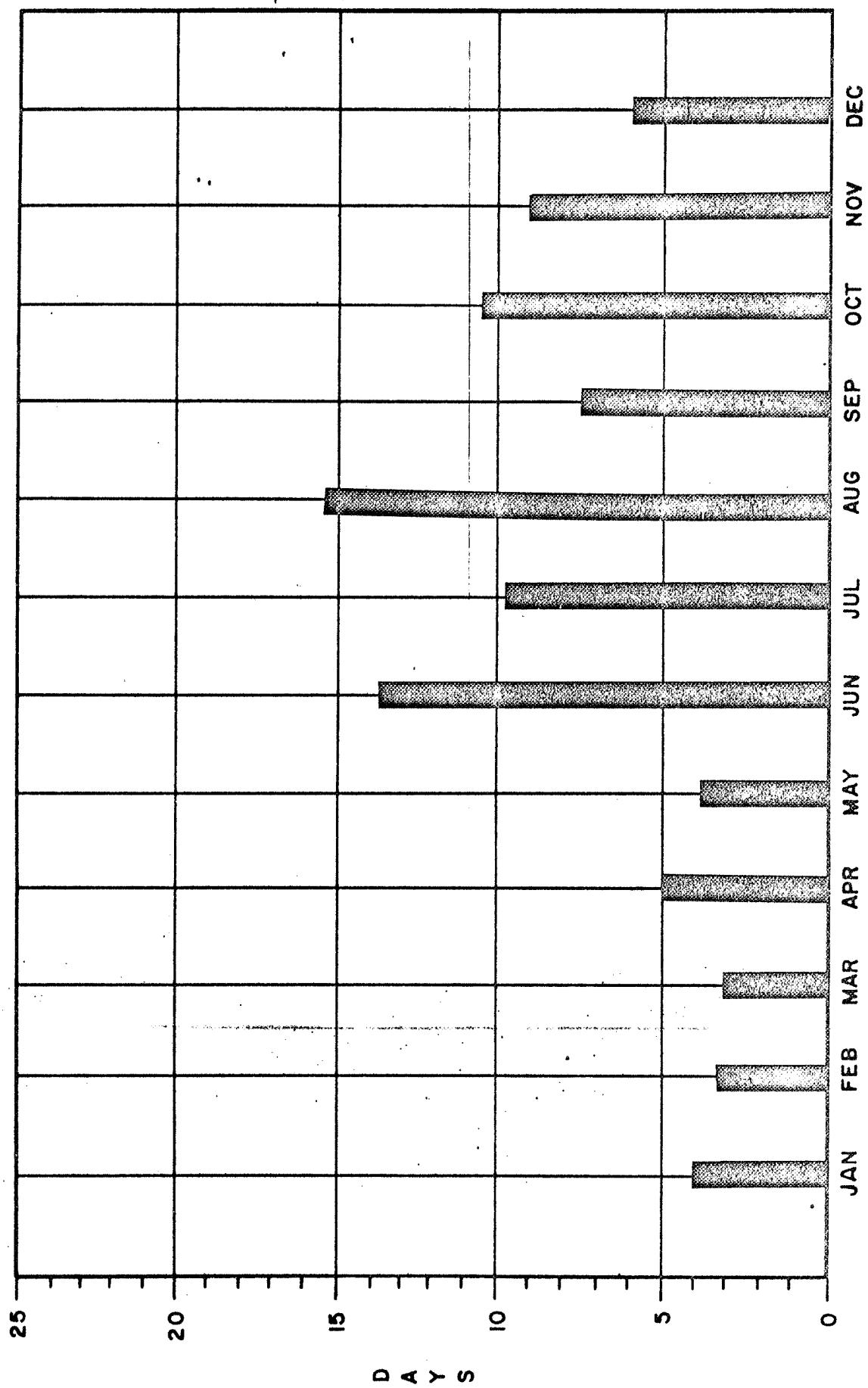
Figure 3-1. Isokeunaic Map of the United States

D. LIGHTNING DATA 1964-1969

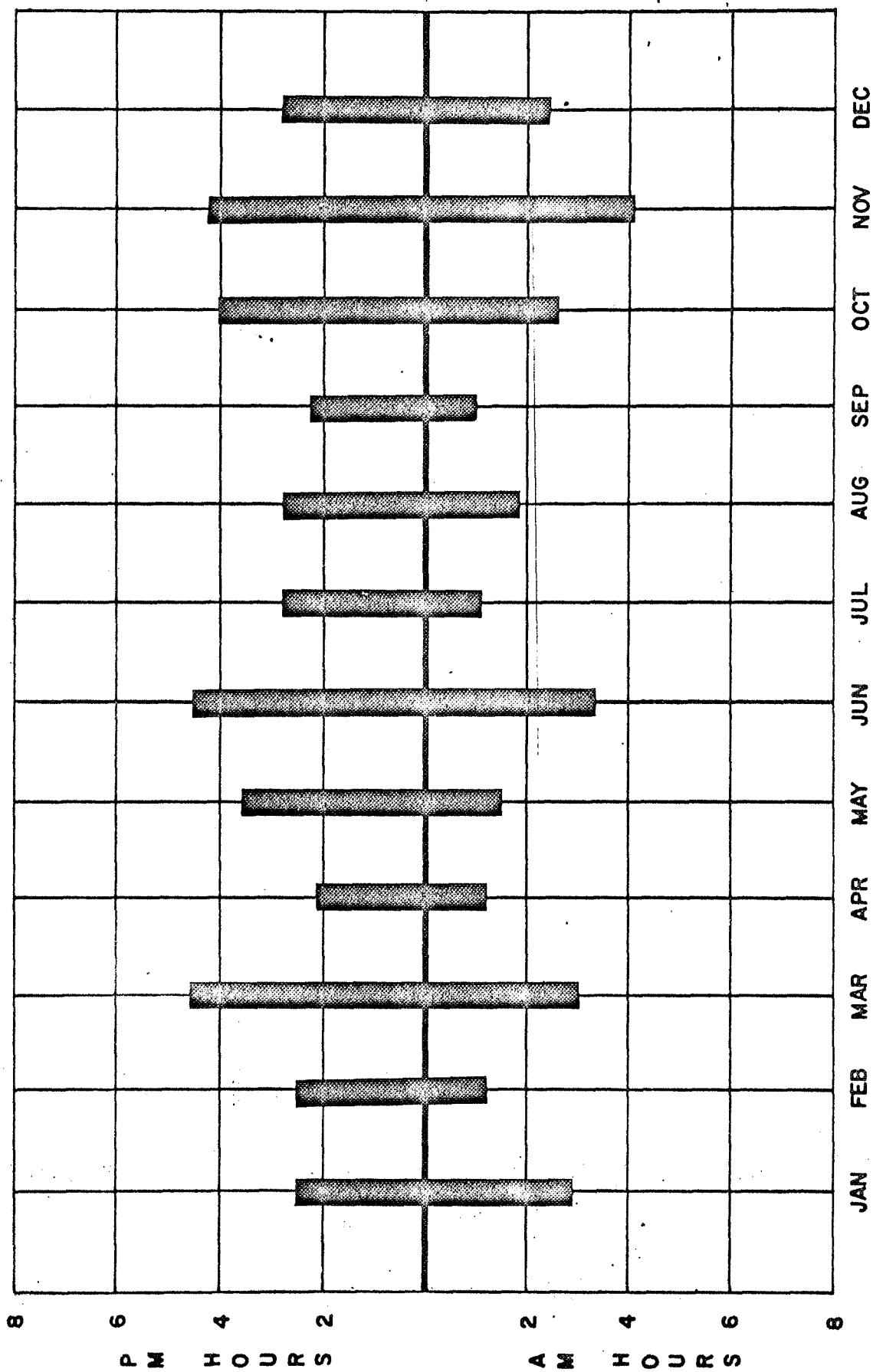
The following tables and data charts present lightning activity records for the KSC launch area, 1968 through 1969; KSC industrial area, 1965 through 1969; and the CKAFS, 1964 through 1969.

Table 3-3. Summary of Average Activity Days per Month, KSC Launch Area 1968-1969

Month	Activity Days	
	Potential Gradient	Stroke
Jan	4.0	0.8
Feb	3.3	1.2
Mar	3.1	1.5
Apr	5.0	0.8
May	3.8	1.5
Jun	13.5	6.5
Jul	9.8	6.3
Aug	15.5	10.2
Sep	7.5	5.5
Oct	10.5	4.4
Nov	9.0	3.7
Dec	6.0	6.3



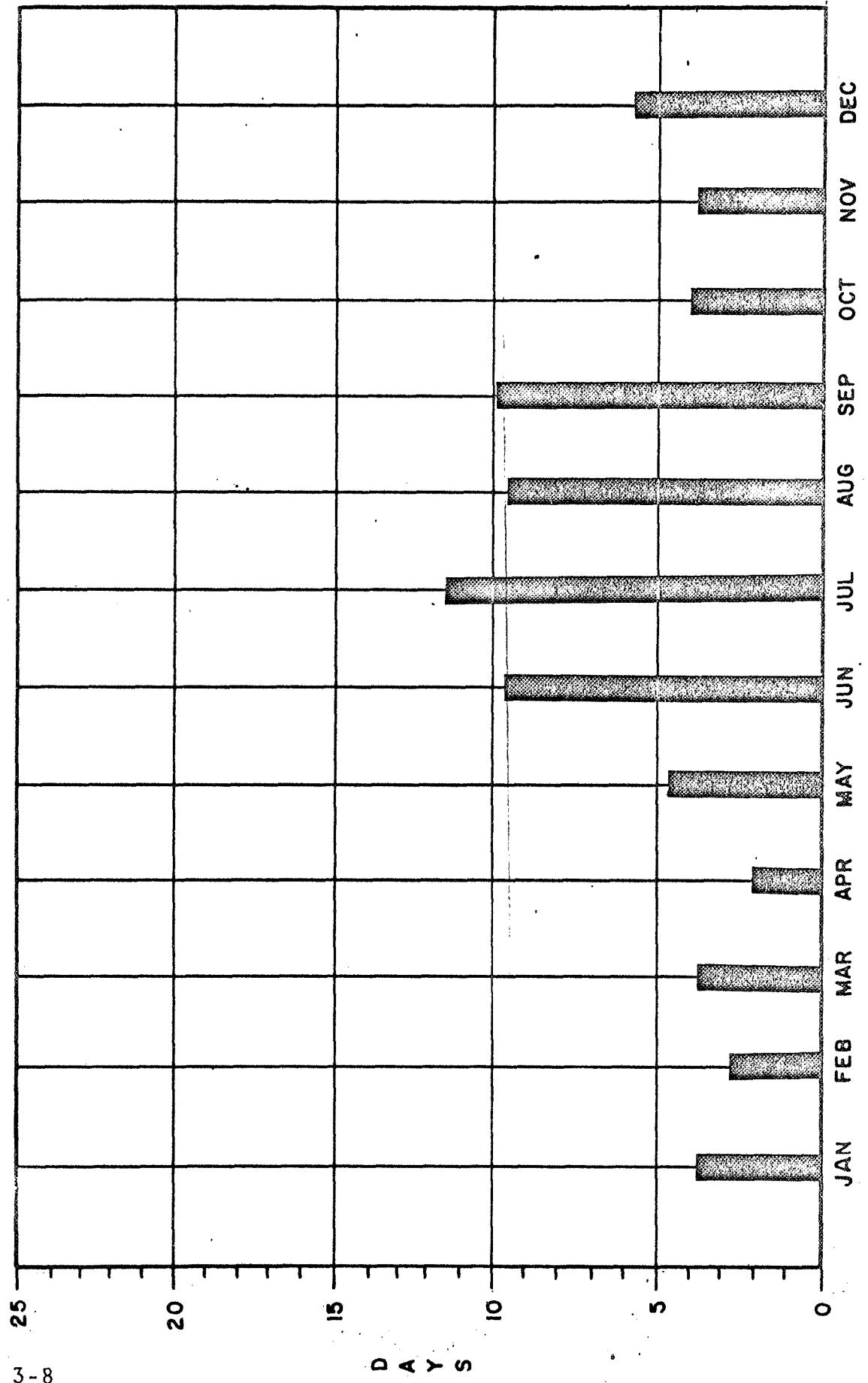
Average of Potential Gradient Activity Days per Month,
KSC Launch Area 1968 Through 1969



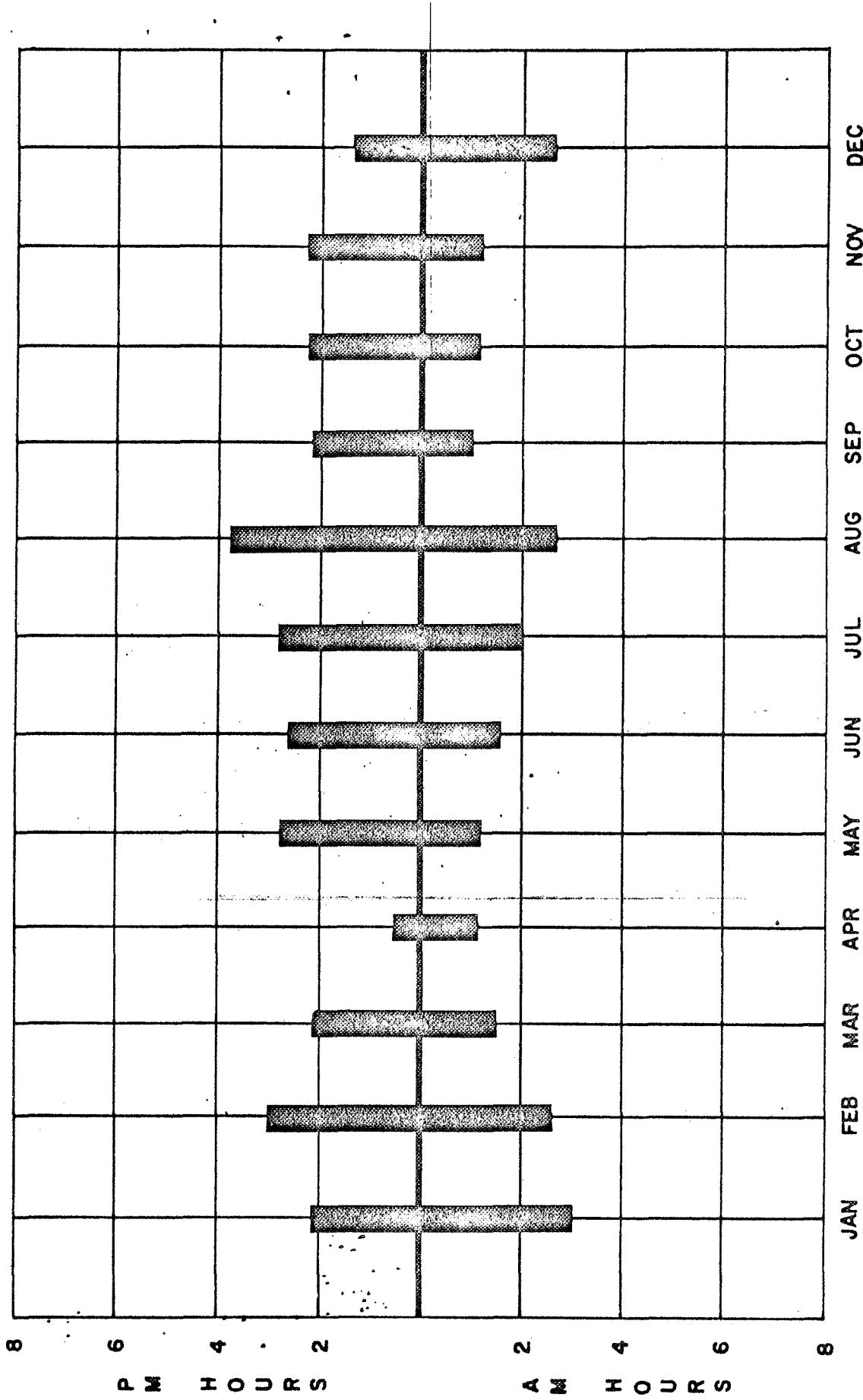
AM and PM Distribution of Average Potential Gradient Activity
Hours per Month, KSC Launch Area 1968 Through 1969

Table 3-4. Summary of Average Activity Days per Month, KSC Industrial Area 1965-1969

Month	Activity Days	
	Potential Gradient	Stroke
Jan	3.8	0.8
Feb	2.5	1.8
Mar	3.8	2.2
Apr	1.9	0.8
May	4.5	4.6
Jun	9.7	7.5
Jul	11.3	10.3
Aug	9.7	9.1
Sep	9.9	6.4
Oct	3.9	2.9
Nov	3.8	1.1
Dec	5.7	3.5



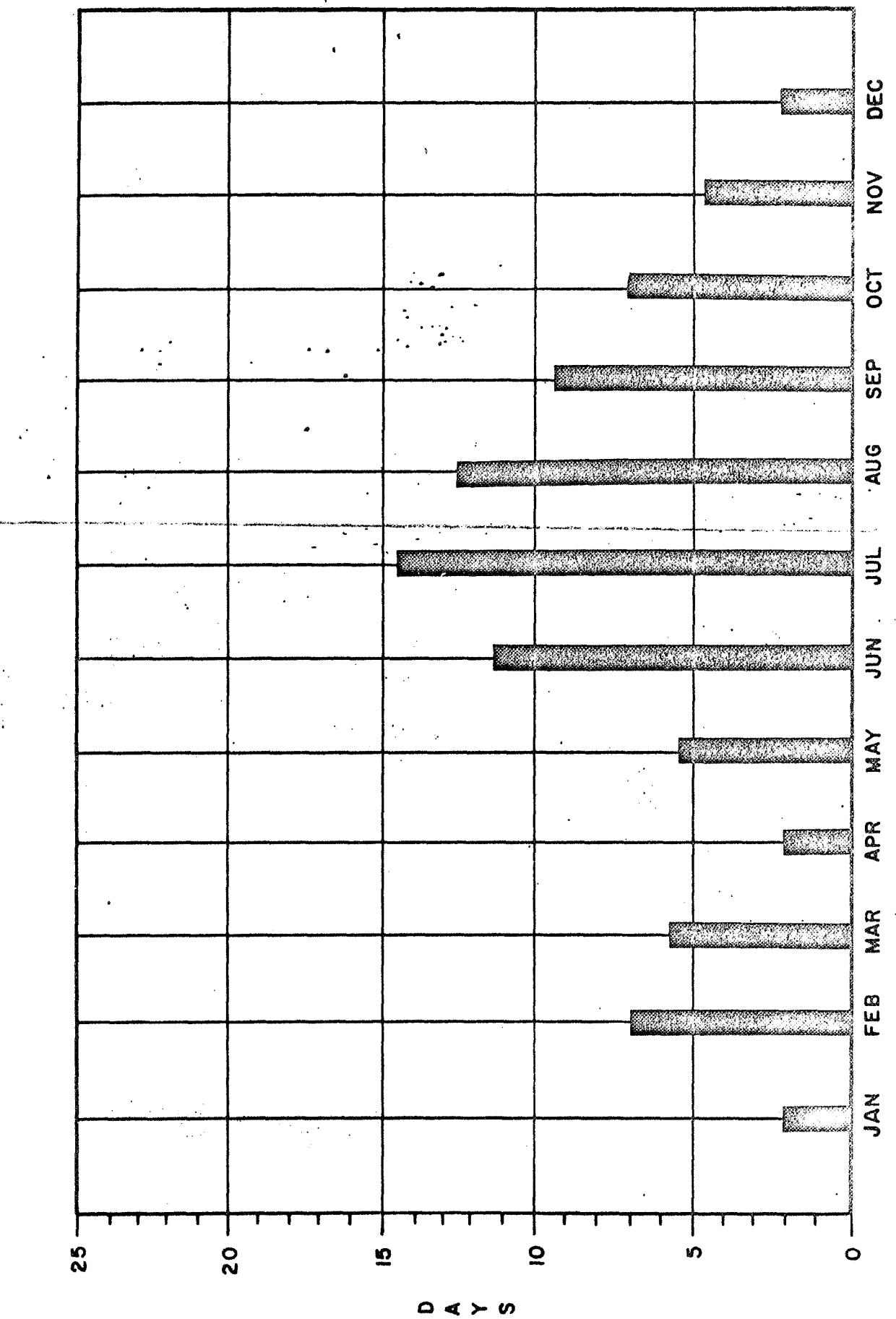
Average of Potential Gradient Activity Days per Month,
KSC Industrial Area 1965 Through 1969



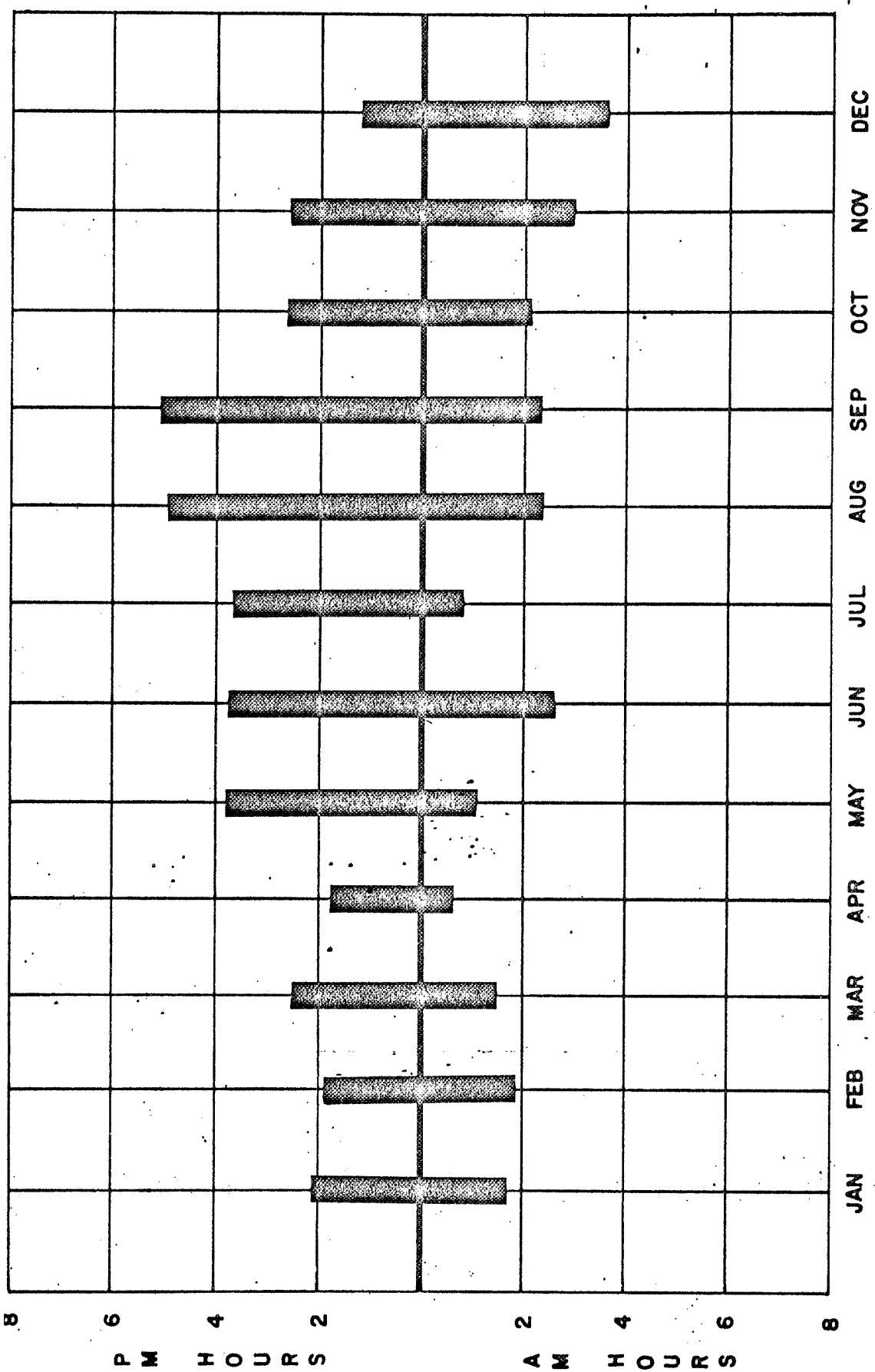
AM and PM Distribution of Average Potential Gradient Activity Hours per Month, KSC Industrial Area 1965 Through 1969

Table 3-5. Summary of Average Activity Days per Month, CKAFS 1964-1969

Month	Activity Days	
	Potential Gradient	Stroke
Jan	2.0	0.5
Feb	7.0	3.0
Mar	5.7	1.2
Apr	2.0	0.2
May	5.4	5.0
Jun	11.4	7.4
Jul	14.6	13.0
Aug	12.5	8.5
Sep	9.3	6.3
Oct	7.0	2.5
Nov	4.6	1.6
Dec	2.0	1.2



Average of Potential Gradient Activity Days per Month,
CKAFS 1964 Through 1969



AM and PM Distribution of Average Potential Gradient Activity
Hours per Month, CKAFS 1964 Through 1969

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1. Alexander, W. H., "Distribution of Thunderstorms in the United States," Monthly Weather Review, volume 2, p 337, 1924.
2. Lightning Protection for Saturn Launch Complex 39, General Electric Company, NASw-410, September 10, 1963.
3. Analysis of Lightning Effects LC-34/37, p 2-3, General Electric Company, NASw-410, July 1, 1964.
4. Chalmers, J. A., Atmospheric Electricity, Pergamon Press, New York City, 1957.

APPROVAL

KSC LIGHTNING SUMMARY REPORT
THROUGH 1969

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